



PHUSICOS

According to nature

Deliverable 5.3

PHUSICOS Policy-Business Forum

Governance innovation for the design, financing and implementation of NBS, and their application to the concept and demonstration projects

Work Package 5 – Governance innovation for the design and implementation of nature-based solutions

Deliverable Work Package Leader:
International Institute for Applied Systems Analysis

Revision: [No.] – Final
Dissemination level: Public

April 2023



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776681.

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The present document has not yet received final approval from the European Commission and may be subject to changes.

Note about contributors

Lead partner responsible for the deliverable:	University of Geneva (UNIGE) and the International Institute for Applied Systems Analysis (IIASA)
Deliverable prepared by:	Anna Scolobig* (UNIGE), Julia J. Aguilera Rodríguez (UNIGE) Juliette C. G. Martin* (IIASA), JoAnne Linnerooth-Bayer* (IIASA)
Partner responsible for quality control:	Norwegian Geotechnical Institute (NGI)
Deliverable reviewed by:	Anders Solheim (NGI), Mark Pelling, University College London, (UCL)
Other contributors (in alphabetical order):	Jörg Balsiger, UNIGE Nicola Del Seppia, Northern Apennines Hydrographic District Authority Alberto Fresolone-Caparrós, IIASA Eva Garcia, The Working Community of the Pyrenees Sabine Kraushaar, University of Vienna Didier Vergès, The Working Community of the Pyrenees Turid Wulff Knutsen, Innlandet County Aude Zingraff-Hamed, Technical University of Munich

* These authors contributed equally to this work.

Project information

Project period:	1 May 2018 – 30 April 2023
Duration (no. of months):	60
Website:	www.phusicos.eu
Project coordinator:	Norwegian Geotechnical Institute, (NGI project no.: 20180404)



Acronyms

ADBS	Northern Apennines Hydrographic District Authority (Autorità di Bacino Distrettuale dell'Appennino Settentrionale)
CAP	Common Agricultural Policy
CIRF	Italian Centre for River Restoration (Centro Italiano per la Riqualificazione Fluviale)
CMCC	Euro-Mediterranean Centre on Climate Change (Centro Euro-Mediterraneo sui Cambiamenti Climatici)
COP	Conference of the Parties
CTP	Working Community of the Pyrenees (Consortio de la Comunidad de Trabajo de los Pirineos/Communauté de Travail des Pyrénées)
DRR	Disaster Risk Reduction
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECB	European Central Bank
EEA	European Economic Area
EIB	European Investment Bank
EU	European Union
FGC	Catalan Government Railways (Ferrocarrils de la Generalitat de Catalunya)
IIASA	International Institute for Applied Systems Analysis
IUCN	International Union for Conservation of Nature
NBE	Nature-based Enterprises
NBS	Nature-based Solutions
NGI	Norwegian Geotechnical Institute
NGO	Non-Governmental Organization
OPCC	Pyrenean Climate Change Observatory (Observatoire Pyrénéen de changement climatique)
ORF	Austrian Broadcasting Corporation (Österreichischer Rundfunk)
PBF	Policy-Business Forum
PPF	Project Preparation Facility



PPP	Public-Private Partnerships
UNDP	United Nations Development Programme
UNEA	United Nations Environment Assembly
UNFCCC	United Nations Framework Convention on Climate Change
UNIGE	University of Geneva
UNIVIE	University of Vienna
UPM	Polytechnic University of Madrid (Universidad Politécnica de Madrid)
VR	Virtual Reality
WWF	World Wide Fund for Nature

Summary

The European Commission is investing considerably in Nature-based Solutions (NBS) and green growth with the goal of positioning Europe as a leader in ‘innovation with nature’. Research and practice are increasingly providing solid foundations for NBS implementation and unprecedented political momentum now exists for scaling up NBS with increased funding opportunities available. For example, the European Union (EU) Biodiversity Strategy outlines an ambitious plan to unlock at least €20 billion a year for spending on nature, and the European Investment Bank’s Natural Capital Financing Facility (EIB NCF) allocated €250 billion to the EU Green Deal. However, to realize their full potential, NBS must be mainstreamed into local, national, and international governance regimes, including regulatory and financial procedures, as well as risk management, land use, and spatial-planning strategies. Moreover, in disaster risk reduction (DRR) and climate change adaptation, NBS policies are still poorly applied, especially at local and national levels.

Some of the questions addressed in [PHUSICOS](#) Work Package 5 (“Governance innovation for the design and implementation of nature-based solutions”) Policy-Business Forum (PBF) include: What changes are needed to help catalyse policy adoption and innovation for NBS? What role do the private and public sectors play in mainstreaming NBS? and How can governance innovation be promoted? This deliverable describes the activities and main results of the PBF, whose overall aim is to explore innovative ways to strengthen the science-policy-business nexus to exploit opportunities and overcome barriers in NBS implementation. The specific aims of the PBF are to deliberate on possible improvements of existing policies, instruments, and initiatives to improve NBS implementation, and to propose new ideas for governance and policy structures that can lead to greater success on NBS acceptance and application. The PBF includes NBS experts and knowledgeable stakeholders at the national, European and international scales. During the PHUSICOS project, over 70 stakeholders were involved in PBF deliberations through interviews, web meetings/e-consultations, and workshops. The key themes discussed in the deliberations included governance innovation for NBS, the role of the public and private sectors in mainstreaming NBS, and capacity-building.

PBF participants, which included PHUSICOS members and others, identified several important barriers to NBS implementation. They also determined policy and finance options to overcome these barriers and to promote innovation. In this deliverable, we discuss selected governance, financing and capacity-building innovations and applications related to the PHUSICOS project concept and demonstration projects or others as suggested by PBF participants.

Based on the PBF deliberations, we identified four main recommendations with suggested innovations to unlock the potential of NBS. Presented below, without an order of importance, these PBF recommendations are meant to motivate further research and discussion.

Recommendation 1: Update EU policies and promote mandatory policy instruments.

To date, despite the acknowledgement of the significance of NBS in many EU policy initiatives (e.g. EU Green Deal, EU Strategy on Adaptation to Climate Change, EU Biodiversity Strategy, and the EU Flood and Water Directive), these initiatives often lack both a legal obligation to comply and quantitative and measurable implementation targets. This leads to fragmented adoption of and limited opportunities for NBS implementation. To address this challenge, the following innovations were suggested:

- Enforcing legally binding targets, e.g. reservation of a proportion of land for forest cover in Member States as in the proposed EU Nature Restoration Law;
- Streamlining simplified NBS approval procedures, e.g. by introducing self-certification schemes;
- Switching the burden of proof to grey measures, e.g. make consideration of NBS a requirement for infrastructure projects, make NBS compulsory as elements of landscape planning; and/or require stringent documentation of the long-term negative impacts of grey infrastructure;
- Fostering policy synergies by linking NBS policies to well-being and preventative healthcare policies or to green infrastructure, transport and mobility policies, e.g. joint biodiversity and climate plans at regional or national level; and
- Promoting cross-sectoral and multi-level collaboration and polycentric governance arrangements, e.g. cross-sectoral secretariats for NBS strategies.

Recommendation 2: Mobilize public and private finance.

Insufficient funding, unbalanced distribution of public funds for green and grey measures, and investments in nature-negative projects are barriers hindering the uptake of NBS. Green washing and path dependency of grey measures are adding to the problem, hindering NBS implementation and indirectly affecting public and private finance decisions. Moreover, the identification of 'bankable' projects presents a formidable challenge to private financing, together with the lack of information on NBS effectiveness, unfavourable regulations, lack of awareness on behalf of enterprises, and difficulties in shifting norms and culture away from traditional grey solutions. To overcome these barriers, the following innovations may be considered:

- Unlocking public and private funding for nature-positive activities with a specific focus on funding for climate adaptation/disaster risk reduction;
- Merging complementary funding streams (green and grey) into single programmes that prioritize NBS, such as disaster risk reduction plans or water management plans;
- Developing innovative financing mechanisms, e.g. resilience bonds or payments for ecosystem services to address land availability problems;
- Promoting co-financing options, e.g. subsidies and tax rebates for NBS investments;

- Promoting partnerships between the public sector, financial institutions, and private enterprises and applying blended financing models, e.g. collective investment and stewardship schemes;
- De-risking NBS, e.g. insuring NBS to transfer risk of project design, construction and loss-and-damage from extreme weather; providing government guarantees for operational and liability risk; innovating with community-based insurance schemes;
- Divesting from nature-negative projects and investing in nature-positive activities, e.g. expansion of EU taxonomy for sustainable finance.

Yet, despite the need to divest from grey infrastructures, it is essential to keep in mind that in some cases (especially in case of high risk when loss of life is expected), hybrid or grey solutions may still be the preferred to guarantee high safety standards.

Recommendation 3: Prioritize research and a robust knowledge base.

Knowledge gaps in NBS effectiveness, resulting largely from a lack of NBS monitoring, assessment and co-benefit evaluation, are a main reason for a lack of formal NBS standards. Knowledge gaps can be addressed with a host of measures, including:

- Increasing monitoring to track short- and long-term impacts;
- Strengthening evidence on NBS effectiveness;
- Developing formal standards, including building codes and insurance regulations based on the evidence created;
- Improving co-benefit evaluation and quantification, e.g. by better including and explaining NBS multi-functionality in climate adaptation and disaster risk reduction plans;
- Improving tools to compare NBS, hybrid and conventional solutions.

Recommendation 4: Train the workforce and build capacities.

Small- and medium-sized enterprises often contribute to NBS implementation, playing a paramount role, especially in their design and construction. However, many enterprises encounter challenges ranging from a lack of NBS knowledge, basic business and marketing skills to a lack of practical experience in implementing NBS. Moreover, specialized enterprises are in short supply. To support private-sector upscaling, options include:

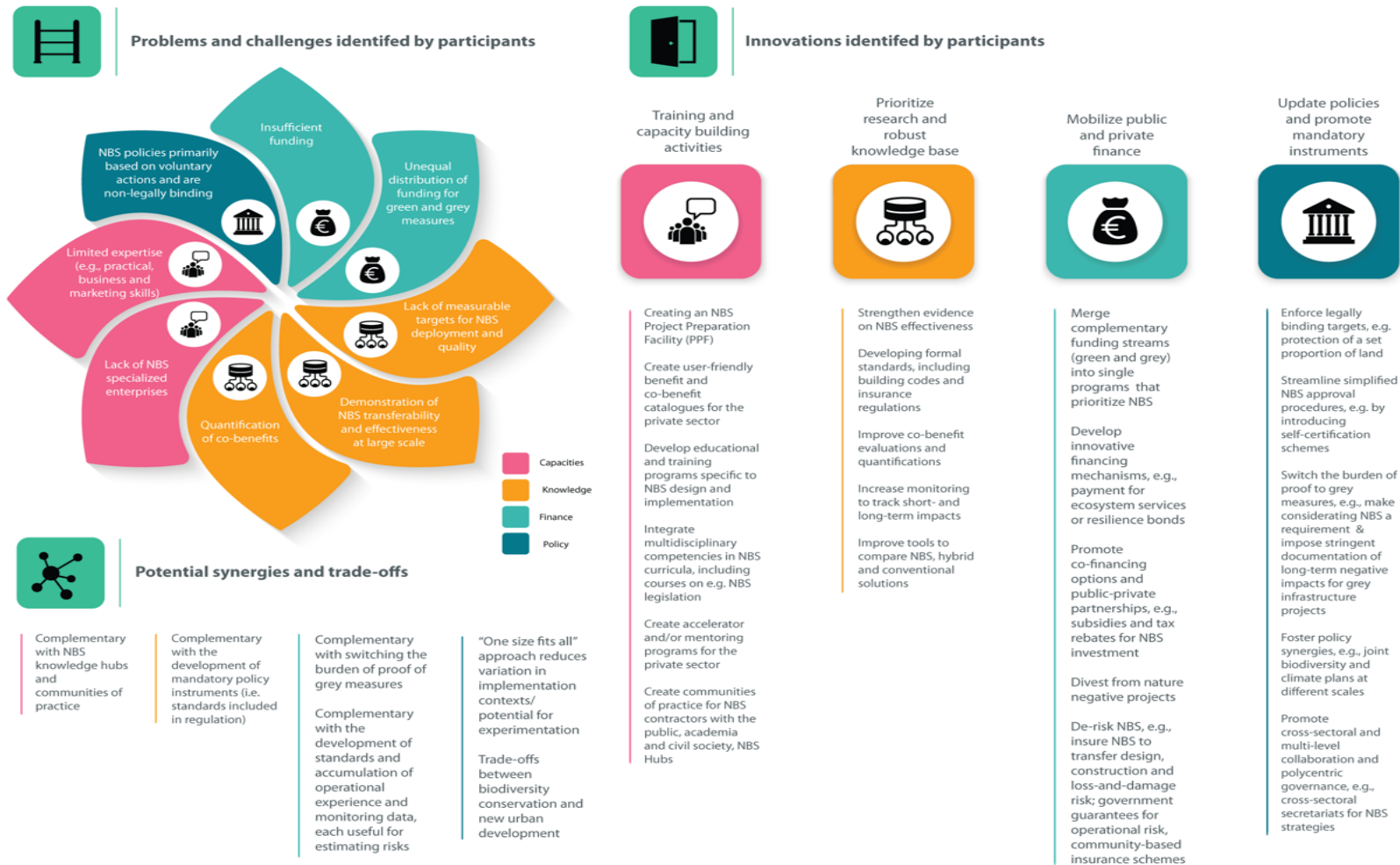
- Creating an NBS Project Preparation Facility (PPF) at the local and/or national level by providing support to nature-based enterprises, e.g. in the formulation of feasibility studies, risk assessments and tender applications;
- Creating user-friendly benefit and co-benefit catalogues for the private sector;
- Developing new educational and training programmes specific to NBS design and implementation, including on available guidelines and standards, e.g. the IUCN Global Standard for NBS;
- Using innovative learning tools, e.g. virtual-reality learning platforms;

- Integrating multidisciplinary competencies in NBS curricula, including courses on NBS legislation;
- Creating accelerator programmes/mentoring to offer start-ups growth and learning opportunities through intensive funding and mentoring for a brief period;
- Creating communities of practice for NBS contractors with the public, academia and civil society through NBS Hubs.

Synergies, trade-offs, priorities among the suggested innovations and interconnections between them and their application in different countries and contexts could be further explored in future research.

We hope that these suggested innovations will foster debate to unlock the potential of NBS and to bridge the policy, financial and implementation gaps.

Graphic summary. Overview of NBS implementation challenges and opportunities identified by PBF participants





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1 Introduction

There is growing recognition that nature-based solutions (NBS) can help provide viable and cost-effective solutions to a broad range of societal challenges. NBS are defined here as actions taken “to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits” (UNEA, 2022; see White House, 2022 for an overview of NBS definitions). NBS include climate change adaptation and disaster risk reduction (Ozment et al., 2019), which are the focus of PHUSICOS, an Innovation Action project funded by the EU Horizon 2020 research and innovation programme (Grant agreement No. 776681). The main objective of PHUSICOS is to demonstrate that NBS for reducing natural hazard risk of extreme weather events in rural mountain landscapes are technically viable, cost-effective, and implementable at regional scale. For example, restoring native ecosystems can promote healthy soil and vegetation, thus reducing the risk of floods, erosion, droughts, and landslides by increasing infiltration, water storage, water quality, and the stabilization of slopes and shores (Seddon, 2022). Other examples include the use of NBS vs. grey solutions for flood protection; trees and parks for cooling homes and forest restoration for reducing wildfire severity (White House, 2022). NBS implementation can have significant consequences at multiple levels – for example, local wetlands prevented loss of life and saved communities \$625 million in damage during Hurricane Sandy (*ibidem*).

NBS can also contribute to meeting multiple goals and generating benefits linked not only to climate adaptation, but also to mitigation, biodiversity, well-being, sustainability, and equity. They include a wide range of actions, from planting trees and changing food production methods to reducing waste and taking action on oceans. Furthermore, investing in nature has proven to be a promising strategy that simultaneously delivers co-benefits that can enhance ecosystem-based disaster risk reduction, increase social and ecological resilience, protect ecosystems, and improve livelihoods, all through the maintenance, restoration, and sustainable use of ecosystems and their services, while addressing other significant policy agendas such as biodiversity and livelihoods (Cohen-Shacham, 2016; Palomo et al., 2021; Ruangpan et al., 2020; Seddon et al., 2020; Seddon, 2022).

In 2022, NBS were included for the first time in the Conference of the Parties (COP 27) decision text, which encourages Parties to consider, as appropriate, nature-based solutions or ecosystem-based approaches, taking into consideration United Nations Environment Assembly resolution 5/5, for their mitigation and adaptation action while ensuring relevant social and environmental safeguards.

Thus, while ambition to implement NBS is growing at the international level, NBS must be mainstreamed into local, regional and national governance regimes, including regulatory and financial procedures, as well as into risk management, land use and spatial planning strategies to realize their full potential. Also, the challenges to NBS implementation must be properly addressed. Prior assessments of NBS feasibility must

be carried out and potential negative consequences and missed opportunities should be considered on a case-by-case basis.

In this deliverable (D5.3.) of [PHUSICOS](#) Work Package 5, “Governance innovation for the design and implementation of nature-based solutions”, we delve into some of the open issues linked to the realisation of the full potential of NBS, with the aim to identify the governance, policy and finance reforms necessary to drive transformative action – here defined as “a profound and often deliberate shift initiated by communities toward sustainability, facilitated by changes in individual and collective values and behaviours, and a fairer balance of political, cultural, and institutional power in society” (IPCC, 2018, p.558). We present the results of the PHUSICOS PBF that consists of NBS experts and knowledgeable stakeholders at the national, European and international scale. The PBF aimed to better understand the current state of NBS governance and, more importantly, to identify new pathways for NBS transformative action by addressing questions such as: What public policies need to be in place to effectively support NBS? What is the role of the public and private sector in mainstreaming NBS? How can we upscale NBS implementation and what role do Nature-Based Enterprises (NBE) play?

By addressing these questions identified through an iterative process and by integrating scientific evidence and inputs from the PBF participants (see section 3 for a methodological description), the PBFs intended to suggest innovations to unlock the potential of NBS. In total, 74 stakeholders were involved in the Forum deliberations in various ways, including interviews, web meetings/e-consultations, and workshops. Specifically, stakeholders deliberated on how to improve the use of existing policies, instruments, and initiatives to better enable the implementation of NBS. They also discussed how to propose new ideas for governance and policy structures that can lead to greater success on NBS acceptance and implementation. Three core themes were co-identified with the stakeholders involved, and include:

- Governance and policy innovation;
- Finance innovation and the role of different sectors in mainstreaming NBS; and
- Private sector capacity building.

These themes represent the thread of this deliverable. In section 2, we describe the background, in section 3 we look at the methodology and, in section 4, the results. We conclude with future perspectives and suggested innovations for NBS transformative action. In the appendices we include a complete overview of PBF agendas, participants and activities.

2 Background

In this section, we describe the key themes addressed in the Policy-Business Forum (PBF): policy and governance, finance and the private sector role, and capacity building. We identify the main issues, gaps and challenges linked to each.

2.1 Policy and governance

NBS-policy analyses have examined if and how regional, national, and international policy frameworks address the concept of NBS and make conclusions about these frameworks and the extent of their attempts to enhance NBS use (Davies et al., 2021). At the European level, these analyses revealed that the European Commission (EC) is investing considerably in NBS and green growth, with the goal of positioning Europe as a leader of 'innovation with nature' (Davies et al., 2021; EEA, 2021). Partially because of this push, NBS are seen in several different policy domains, including adaptation, disaster risk management, research and innovation, biodiversity, and water retention. For example, NBS are included in the new EU Strategy on Adaptation to Climate Change, in which they are considered essential for increasing climate resilience and sustaining healthy water, oceans, and soils (EC, 2021). The recently released EU Biodiversity Strategy and the EU Forest Strategy, both for 2030 (EC, 2020) representing key pillars of the ambitious European Green Deal (EC, 2019), also rely on NBS to both increase climate resilience and preserve and restore ecosystem integrity. A further crucial milestone of the EU Biodiversity Strategy is the recent Nature Restoration Law, which is pioneering the inclusion of legally binding nature restoration targets across Europe (Directorate-General for Environment, 2022).

NBS are also increasingly featured in EU policies and strategies beyond conservation and environmental protection. For example, the Farm to Fork Strategy (EC, 2020) promotes the use of NBS such as agroecology practices to transition to a sustainable food system. Likewise, an analysis of EU-funded projects emphasised the direct relevance of the EU Flood Directive and Water Framework Directive for NBS implementation (Vojinovic, 2020). For example, the EU Floods Directive has been successful in inspiring at least 26 Member States to include natural water retention measures, a form of NBS, into their plans.

Although these actions have advanced the conceptualization and operationalization of NBS in Europe, much wider adoption is needed to reach the ambitious goals of the European Green Deal (Calliari et al., 2022). Indeed, analyses of NBS policies reveal a predominantly non-binding instrument mix for NBS and related concepts. Policies are based largely on voluntary action and often lack quantitative and measurable targets for NBS deployment and quality evaluation (Davis et al., 2018). Going back to one of the previous examples, the new EU Strategy on Adaptation to Climate Change (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Forging

a Climate-Resilient Europe - the New EU Strategy on Adaptation to Climate Change, 2021) identifies NBS as a cross-cutting priority and outlines the need for Member States to promote them. This Strategy also emphasizes the importance of bringing nature into the climate dialogue in the form of NBS for adaptation and mitigation. The Strategy also maintains that the EC will propose NBS for carbon removals, including accounting and certification in upcoming carbon-farming initiatives; develop the financial aspects of NBS and foster the development of financial approaches and products that also cover nature-based adaptation; and continue to incentivize and assist Member States to rollout NBS through assessments, guidance, capacity building and EU funding. However, the Strategy does not require specific actions, such as the development of national adaptation strategies integrating NBS for climate change adaptation and disaster risk reduction.

Many other policies also explicitly describe the benefits of nature, allude to their potential to address societal challenges, and encourage action to adopt or promote such measures, however, they often do not go further than encouragement, failing to set standards or mandate supportive action, policy or financial instruments (Davies et al., 2021). Furthermore, the complex mosaic of policy instruments addressing NBS in Europe can lead to confusion among decision-makers, fragmented governance and, eventually, policy stalemates (EEA, 2021; Trémolet, 2019). Somarakis et al., (2019) note the lack of coherence both in EU and sectoral policies relating to NBS. Further alignment of sectoral policy instruments is thus needed to facilitate cross-sectoral (and by extension polycentric) governance arrangements for NBS (EEA, 2021). Similarly, Vojinovic (2020) highlights the need for enhanced exploitation of synergies between different EU policy instruments. A further related challenge is the risk for EU-wide NBS ambitions to be ‘watered down’ once they reach the Member State level due to a lack of coordination between Member State governments and the EU (Schebesta & Candel, 2020).

Within Member States, multiple policy instruments explicitly acknowledge NBS and related concepts, sometimes even including them in their strategic objectives (e.g. German Green and White Papers on Urban Green, Federal Strategy on green infrastructures, Spanish National Natural Heritage and Biodiversity Law), but there are still glaring gaps in the identification of quantitative and measurable targets (*ibidem*) and NBS are not mainstreamed into existing national policies. Indeed, while NBS are featured in a large proportion of Nationally Determined Contributions and national adaptation plans (Seddon et al., 2020), this has not yet translated into their widespread implementation in Europe and beyond.

This implementation gap (i.e. the mismatch between NBS ambitions and on-the-ground implementation) has been noted in several studies and maps well onto the “policy-action” gap identified in the latest IPCC report (Dodman et al. 2022). The policy-action gap arises when administrative, communication, financial and other organisational blockages and inertia interrupt policy implementation, the intent of political leadership and delivery of adaptation interventions on the ground (*ibidem*: 969). For example, Runhaar et al. (2018) find that in many European countries, the lagging of policy integration of adaptation strategies, including NBS (see UNEP, 2022a), is likely due to a lack of both long-term political commitment and effective coordination between key

stakeholders. In Switzerland, the adaptation gap was also attributed to a lack of political commitment at the national and cantonal levels (Braunschweiger et al., 2021). Frantzeskaki et al. (2020) highlight the need for national policies to foster institutional spaces for collaborative learning and targeted capacity-building programmes (see also section 2.3).

The need for NBS national policies is parallel with the need for maturation of NBS governance, which goes beyond ‘government’ and the arrangements it encompasses to include a network of state, non-state and business actors in the process of deciding on and implementing NBS policies (Lemos & Agrawal, 2006; Steurer, 2013; Martin et al., 2019, 2021; Lupp et al., 2021). As such, governance also encompasses the social, legal, institutional, political, and financial conditions through which NBS are implemented (Bernardi et al., 2019). Governance innovation may therefore foster the prioritisation of NBS as either a complement or alternative to traditional grey infrastructure approaches, promote a wider uptake, and increase public awareness due to collaborative design and implementation processes (Seddon et al., 2020).

Key governance components include sectoral integration (i.e. number of sectors and institutional mechanisms linking them); vertical coordination (i.e. diversity and nature of involvement by governmental actors at different levels); stakeholder participation (i.e. degree and nature of involvement of non-governmental organizations and the private sector); science-policy interface (i.e. nature of institutional mechanisms for bilateral exchange between policy makers and scientists); and funding arrangements (i.e. assessment of funding sources and outlays) (Balsiger et al., 2020). All of these elements have also been shown to be essential for enabling NBS implementation (Martin et al., 2021).

The diverse challenges to NBS governance depend on a complex array of conditions including policy frameworks, political regimes, institutions as well as local socio-economic contexts (Faivre et al., 2017; Naumann et al., 2020). Nevertheless, several challenges are shared, such as the need to exit grey-solution path dependency, to balance the competing demands of preserving/restoring nature while keeping pace with urban and rural growth and existing institutional settings. For example, local governments face persistent planning challenges regarding the integration of new knowledge and new governance approaches due to continued silo thinking, resistance to novelty, policy fragmentation and lack of budget (Martin et al. 2021; Mahmoud et al., 2022). The short-term nature of public and private sector decision-making and budget allocation hinders longer-term planning, management and maintenance of NBS, which are essential to address climate change and biodiversity goals in a sustainable manner (Seddon et al., 2020). Most importantly, NBS may take a long time to show benefits (Solheim et al., 2021). A systematic review of barriers to NBS implementation is provided in PHUSICOS deliverable 5.2. (Martin et al., forthcoming).

Gaps concerning the identification of key innovations that decision-makers and practitioners can adapt on NBS implementation from a governance perspective persist (Frantzeskaki, 2019; Frantzeskaki et al., 2020). This includes identifying relevant policy mechanisms along with levers for institutional reform that can better enable NBS implementation and upscaling (Fedele et al., 2019).

2.2 Finance and the role of the private sector

NBS financing is an area of growing interest to explore and encourage. While it was estimated that an average of USD 154 billion were invested worldwide annually in NBS as of 2022 (UNEP, 2022b), this is still a small percentage of the USD 579 billion spent annually on climate finance in general (UNEP, 2021). This gap is reported as a key barrier for reaching, for example, climate mitigation and adaptation goals within urban landscapes (Toxopeus & Polzin, 2021), yet it also opens a window of opportunity for scaling up, particularly for the private sector. NBS financing refers to securing funds for NBS planning, implementation or/and maintenance and operation (McQuaid, 2020). Currently, NBS financing relies heavily on public financing (83% of total NBS investment), with just 17% coming from the private sector (UNEP, 2022a). Increasing private sector investment would provide a pivotal opportunity to boost NBS deployment.

Two main drivers of private NBS financing have been identified by the World Business Council for Sustainable Development: voluntary actions and regulatory compliance. Voluntary investments are heavily influenced by customers, investors and employees to act on climate change, while regulatory initiatives can possibly generate funds, for example, through the adoption of carbon taxes (World Business Council for Sustainable Development, 2019). However, increasing private investment faces a number of obstacles due to the complexity of NBS solutions, the specificity of the contexts in which they are applied and the multiple benefits and stakeholders involved (Mayor et al., 2021). Barriers include difficulties in capturing revenues given the nature of most NBS benefits as public goods, challenges in valuing and accounting for multiple benefits and co-benefits, lack of predictable long-term revenue streams, and the frequent need for long-term financing (Hagedoorn et al., 2021; Toxopeus & Polzin, 2021). Financial risks to the private sector can be reduced through third-party guarantees, new insurance products, blended financing and other strategies (EIB, 2020).

Diverse economic and financial mechanisms exist that can encourage further private uptake of NBS, e.g. carbon markets, green financial products (e.g. green bonds), payments for ecosystem services, reduced insurance premiums, and public and private funds (e.g. the Adaptation Fund, the European Agricultural Fund for Rural Development, European Regional Development Fund, Climate Asset Management and Mirova Natural Capital) (UNEP, 2020). In the case of NBS for climate change adaptation and disaster risk reduction, support can take the form of incentives (e.g. subsidies and payments), disincentives (e.g. taxes or charges), or risk-financing schemes (e.g. insurance and other risk transfer mechanisms) (Calliari et al., 2022).

At the same time, there is unprecedented political momentum and windows of opportunities for scaling up NBS at the European level with increasing financing opportunities and more solid foundations to implementation provided by research and practice (Davies et al., 2021). For example, the EU Biodiversity Strategy outlines an ambition to unlock at least €20 billion a year for spending on nature, and the Natural Capital Financing Facility of the European Investment Bank allocated €250 billion to the EU Green Deal. Moreover, NBS are playing a role in making the post-COVID 19 recovery and the implementation of the EU Recovery and Resilience Facility green, healthy, just and equitable (European Commission, n.d.). Innovative investment models

are also emerging, such as those of venture funds specifically focused on biodiversity and banks with funds targeted for natural capital (Surminski et al., 2022).

Other ways to reduce financial deficits and requirements include voluntary time contributions from citizens (in the form of unpaid work) to cover part of the labour needs for NBS implementation (Hagedoorn et al., 2021). This strategy is considered to have substantial potential for community-led interventions and for developing countries, where the availability of public funding is generally lower compared to developed nations and where NBS are often donor-driven (Bhattarai et al., 2021).

Regardless of the financing source, there is a consensus in the literature that capital directed to NBS is currently insufficient and that sources other than the public sector must be engaged (UNEP, 2021). Alongside the economic incentives described above, other supportive strategies are essential to facilitate an enabling environment (EIB, 2020; Mayor et al., 2021; Toxopeus & Polzin, 2021; UNEP, 2021). Technical assistance to businesses to identify bankable products and increasing business skills and knowledge on NBS (EIB, 2020), strong public and political leadership, support for the co-design of solutions (Schröter et al., 2022), the creation of standard metrics, baselines, and common characteristics for NBS, and the establishment and integration of environmental and social safeguards in implementation (UNEP, 2021) are among the most prominent.

2.3 Capacity building

The NBS implementation process involves a wide range of stakeholders, making it vital for each of them to have the necessary skills and knowledge to play their role and ensure the optimal performance of the solutions (Mabon et al., 2022). Public authorities are the primary actors behind most phases of NBS implementation, followed by civil society and private companies, or contractors (Zingraff-Hamed et al., 2020).

NBS contractors are hired to do a specific job for a set period and may be involved in various phases of the solutions, including planning, design, construction, or maintenance. They encompass a diversity of firms such as landscape architects, ecologists, consultants, engineers or construction company employees (Kooijman et al., 2021) who work at what can be classified as nature-based enterprises, engaged in an economic activity that directly or indirectly ‘uses the sustainability of nature as a core element of their product/service offering’ (McQuaid et al., 2020). Contractors contribute their expertise and resources to less-experienced project authorities for NBS implementation (Tilt & Ries, 2021).

Yet, recent studies demonstrate that the lack of experience and knowledge of private NBS services providers is one of the main barriers NBS currently face (Solheim et al., 2021; Kuhlicke & Plavsic, 2021; Martin et al., forthcoming). NBS knowledge gaps vary given that these solutions require a multidisciplinary skill set and competencies spanning from academic, to technical and commercial (ILO et al., 2022). For example, many nature-based enterprises with strong technical/ecological skills may have poor business and communication capabilities (McQuaid et al., 2021). These difficulties are particularly acute in cases where companies with little or no prior experience in NBS are recruited, as frequently occurs with construction companies exclusively dedicated to

the deployment of grey infrastructure and which, for various reasons (e.g. impossibility to find other skilled local providers) are given the task of building NBS (Linnerooth-Bayer et al., forthcoming; Mačiulytė & Durieux, 2020).

The effects of insufficient supplier experience in NBS implementation include a low number of bids for projects (McQuaid et al., 2021), poor data collection, difficulties in conducting robust project evaluations to ensure effectiveness (Dimitru & Wendling, 2021), as well as negative impacts on the cost and quality of measures deployed (Mačiulytė & Durieux, 2020). These issues not only affect contractor performance but also overall NBS project results and the perception decision-makers have of such projects. Moreover, outcomes can also be impacted by a still immature NBS policy regime that reduces the capacity to enforce the implementation of such measures.

Developing appropriate skills could assist workers and enterprises in implementing NBS, thus simultaneously creating new and fairly compensated employment opportunities (ILO et al., 2022). However, just and equitable learning opportunities for those in charge of implementing solutions on the ground are required (Mabon et al., 2022). Clear standards and safeguards to guide the design and implementation of NBS are reportedly much in need (UNEP, 2020), as well as exchange platforms to facilitate stakeholder communication and organization. Such platforms are said to be important enablers of NBS upscaling (Fastenrath et al., 2020). These observations are based primarily on the study of past projects and the general exploration of facilitating and hindering factors for NBS. Further research into contractors' perceptions of the limitations they experience and the factors they judge necessary to overcome them is necessary. Deliverable 5.4. of the PHUSICOS project (Linnerooth-Bayer et al., forthcoming) provides an analysis of experiences and needs of NBS professionals working in the provision of NBS services, including designers, construction companies and consulting firms.

3 Methodology

The Policy-Business Forum methodology was grounded on a triangulation of different qualitative social science methods (Silverman, 2010; Bryman, 2012): semi-structured interviews, surveys, and workshops. These techniques allowed us to collect the necessary data for this study.

3.1 Semi-structured interviews and surveys

Semi-structured interviews and questionnaire surveys were carried out as preparatory work with the aim to identify relevant themes for professionals working on NBS governance; to collect relevant information on key challenges related to those themes; and to better understand perspectives on opportunities and gaps. Semi-structured interviews were started several months before the workshops. Overall, a total of 15 interviews were conducted to prepare for the PBF.

Keynote speakers were contacted to provide an overview of the different issues that emerged during the preparatory interviews. The PBF invited participants selected from different communities including scientists and researchers in different fields (ecosystem-based adaptation, disaster risk reduction, eco-disaster risk reduction, political science, governance); practitioners (risk management practitioners in different countries in charge of NBS implementation); European, national, and local authorities in charge of disaster risk reduction; consultancies/private sector members; and civil society representatives and NGO members.

A stakeholder database was set up (Scolobig et al., 2019, PHUSICOS Milestone 5) and used to contact the participants, together with snowballing, using further contacts of those participants who were confirmed or interested. Each PBF workshop had a minimum of 18 and a maximum of 36 participants.

Workshop participants had a variety of backgrounds such as in engineering, natural sciences, social sciences, and business. Most participants work in policy and/or DRR and their interest in NBS had been motivated primarily by the urgency of the climate crisis and the co-benefits of NBS, which aim to address many societal challenges. Moreover, NBS are considered a major chance for co-creation and social inclusion and a new way to build resilience and mitigate disasters. These were strong motivations for conducting NBS-related work.

The workshops took place in 2020, 2021 and 2022. Because of the pandemic and related travel restrictions, they took place online and not in person as initially planned.

In preparation for the PBFs, a short questionnaire was sent to all participants which included different questions:

1. What is your main interest in PBF topics? What motivated your engagement with NBS?
2. What is the single most critical challenge or issue related to:
 - NBS policies for DRR and their transition pathways,

- The role of the public and private sectors for NBS (ideally in the DRR sector), and/or
- NBS private sector upscaling and capacity building?

This might be something you think needs to be addressed, or something specific that has been overlooked in academia or practice for driving NBS transformative action. Where should the collective effort of policy makers, practitioners and academics be directed in the future?

3. What is the single most innovative financial instrument that we need to mainstream to catalyse NBS adoption (ideally in the DRR sector)?
4. What are your expectations for the PBF?

Questionnaire results provided background for the PBF thematic sessions. A summary of the key points raised by all PBF participants in their responses is below (see Table 1). The database of responses for each PBF is available upon request. Selected excerpts of the preparatory interviews and questionnaires have also been used in the results section (section 3).

Table 1. Summary of PBF participant’s motivation and expectations

Question	Answers/key points raised by participants
Source of interest in NBS (motivation)	<ul style="list-style-type: none"> ○ Urgency of climate crisis ○ Co-benefits of NBS helping to address many societal challenges ○ NBS as a chance for co-creation and social inclusion ○ NBS as a new way to build resilience and mitigate disasters ○ Direct involvement in NBS research or NBS projects (design, implementation, financial instruments) ○ Interest in potential new business opportunities ○ Urgency to find NBS funding
Most critical challenge (related to NBS policies)	<p>For policy:</p> <ul style="list-style-type: none"> ○ Limited collaboration among countries to guarantee that international policies are implemented at national and local level (international) ○ Lack of funding to support policy instruments ○ Limited policies/legislation for NBS maintenance ○ Poor regulation at national and regional scale ○ Lack of NBS policy advocacy ○ Limited NBS monitoring and evaluation schemes for DRR (and adaptation) ○ Limited NBS effectiveness assessment and technical guidelines as background for national policy design ○ Lack of assessment frameworks that that could support policymakers in choosing among NBS, hybrid or more traditional solutions <p>For practice:</p> <ul style="list-style-type: none"> ○ Lack of inclusive NBS planning ○ Upscaling and large-scale projects are more interesting for policy makers than small-scale NBS ○ Lack of land to implement NBS

- Lack of political urgency

Most critical challenge related to the role of public and private sector for NBS	<p>Funding-related challenges:</p> <ul style="list-style-type: none"> ○ Gap between available funds and needs and/or expectations (especially in areas with potential risk exposure) ○ Public investment mainly directed towards grey solutions <p>Assessment-related challenges:</p> <ul style="list-style-type: none"> ○ Lack of agreed standards, quantitative targets, measurable indicators, and evaluation tools for NBS in order to assess progress, effectiveness and multiple benefits ○ Difficulties to assess NBS benefits and effectiveness ○ Lack of formal codes for NBS design ○ Lack of formal recognition/quantification of the value of NBS for ecosystems <p>Challenges for the private sector:</p> <ul style="list-style-type: none"> ○ Limited engagement of the private sector ○ Limited return on investment for the private sector <p>Challenges for the public sector:</p> <ul style="list-style-type: none"> ○ NBS not formally included in the Management Plans derived from EU directives 2000/60/EC and 2007/60/EC ○ NBS scepticism
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Most critical challenge related to NBS private sector upscaling and capacity building	<p>Scarcity of:</p> <ul style="list-style-type: none"> ○ Skills and design guidelines ○ Business scenarios/ development models ○ Companies specialised in NBS ○ Validation, formal standards, cost-benefit analyses, good practices ○ Revenue streams for most NBS investments ○ Guidelines for private sector liability in case of NBS failure ○ Insurance regulation ○ Implementation of sustainability criteria for NBS eligibility ○ Expertise needed for NBS planning and implementation ○ Effective education activities for local authorities, technician and construction sector <p>Other challenges:</p> <ul style="list-style-type: none"> ○ Greenwashing ○ Public good nature of most NBS are not in line with expectations for business financing ○ Grey measure path dependency
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Innovative financial instruments (suggested)	<p>“Sticks”:</p> <ul style="list-style-type: none"> ○ Make public investment in grey infrastructure conditional on showing that an NBS would not be cost-effective ○ End financial support for policies that are destructive of nature <p>“Carrots”:</p> <ul style="list-style-type: none"> ○ Tax incentives for long-term commitments ○ Subsidies & compensation, e.g. for micro-investments ○ Common Agricultural Policy payments ○ Support from public banks (e.g. EIB or EBRD) ○ Insurance instruments
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- Ecosystem service payments (transfers from beneficiaries to providers)
- Portfolio of financial instruments adapted to needs

Expectations

To learn more about:

- Governance mechanisms, policies and information needed to accelerate and mainstream NBS uptake
- Financial solutions that can serve to mainstream NBS in mountainous areas
- Financial instruments available in the EU
- Development of public and private partnerships on NBS
- Incentives for private sector engagement
- Role of NBS designers and contractors, NBS business cases
- Quantification of NBS ecosystem contributions
- Best practices and interesting case studies from different European countries
- Role of insurance in the NBS sector
- NBS upscaling (e.g. challenges and opportunities), especially for private sector

To share, discuss and give or receive advice on:

- Experiences and knowledge on NBS across different sectors and scales
- Current NBS governance research
- How to convince decision makers of NBS benefits (NBS business case)
- How to upscale NBS and transpose NBS policies to the local and regional levels
- Options for compensation for long-term NBS maintenance
- New policy opportunities for NBS
- Ideas on how to overcome barriers to NBS implementation
- Applying key outcomes/insights from the presentations and discussions in a company
- Improving a company's NBS offer for customers
- NBS enablers and barriers

To network to:

- Create a collaboration and networking platform
- Connect with other people interested in NBS
- Find partners for Green Deal calls for offers
- Exchange with experts in NBS enterprises
- Identify opportunities for collaboration across EU projects
- Exchange best practices

3.2 PBF workshops

The three PBF workshops had similar structures and agendas: four to five keynote presentations, followed by two thematic sessions. PHUSICOS concepts and demonstration projects and other innovative NBS cases were also presented during the PBF workshops.

The thematic sessions were plenary sessions and provided an opportunity for in-depth discussion of selected questions linked to the theme of each workshop:

- Governance innovation for NBS (24 March 2020),
- The role of public and private sector in mainstreaming NBS (19 April 2021), and
- NBS private-sector capacity-building (18 November 2022), co-organised with the EC-funded project, Network Nature.

For each workshop, we identified core questions based on a literature review of the selected theme, the preparatory interview results and short questionnaires sent to all participants. While the first theme was identified by the research team, the other themes were driven by gaps that emerged during the workshop discussions.

Table 2: Key questions addressed in the PBFs

PBF workshop theme	Key questions
Governance innovation for NBS	<p>How can NBS be mainstreamed into European DRR policy agendas?</p> <p>Will the EU Green Deal result in changing NBS policy?</p> <p>Are new directives and frameworks needed at the European level?</p> <p>If so, which ones (e.g. can the Common Agricultural Policy include incentives for farmers to adopt NBS-targeted DRR)?</p> <p>Are there cross-country differences in the NBS policies and instruments (for DRR) in Europe?</p> <p>What are the main barriers to implement new national policies?</p> <p>Are some countries more advanced than others? Why so?</p> <p>Can NBS effectiveness be measured? How?</p> <p>Do we need new NBS national regulation? If so, on what (e.g. is landslide mitigation in need of legislation about effects of roots systems, including quantification)?</p>
The role of public and private sectors in mainstreaming NBS	<p>How do private sector organisations define priorities for NBS action?</p> <p>What barriers do they encounter?</p> <p>Which of the many innovative market instruments hold promise for NBS scaling?</p> <p>How can public banks provide more funding for NBS?</p> <p>How can public authorities foster synergies, not only between policy sectors but also between the public and private sectors?</p> <p>Are there policies in place that hinder NBS financing?</p> <p>How can we significantly increase funding for the public sector NBS agenda (e.g. COVID-19 recovery fund)?</p>
NBS private sector upscaling	<p>What nature-based enterprise capacities are lacking (e.g. on the part of NBS design and construction) that could enable the upscaling of NBS? How can these capacities be built, and by whom? What are the priorities?</p> <p>What are the main existing policies, mechanisms and/or resources that could help overcome capacity gaps to support NBS upscaling?</p> <p>What are the main risks associated with the design, construction, operation, and maintenance of NBS? Who or what institutions can be held responsible for such risks?</p> <p>In the event of failure of NBS to protect material assets and human lives (e.g. in DRR interventions), who can be held responsible or even liable? Have insurers played a role (or can they play a role) in de-risking NBS performance?</p> <p>What policies, guidelines and regulations have been (or should be) put in place to alleviate NBS failure concerns?</p>

After the workshops, we prepared a synthesis based on the recording of the preparatory semi-structured interviews, the results of the surveys administered to the participants before the workshops, and workshop recordings and notes. To analyse the data, we used standard qualitative data analysis techniques (Bryman, 2012; Silverman, 2010). More precisely, we identified the core themes emerging from the deliberations, accompanied by selected significant quotes. To ensure that our syntheses reflects participant views, we shared the draft with the participants and gave them the opportunity to comment, revise or add further contributions. Also, we asked for participants' consent to quote them and added them as co-authors of the final documents. However, the co-authoring of the synthesis was not possible for the final workshop because there were too many participants. The draft document was still sent out for comments.

The final versions of the three syntheses (Scolobig et al., 2020; Scolobig et al., 2021; Aguilera-Rodriguez et al., 2022) serve as background for this deliverable, together with a review of the relevant literature. The results of the literature review are summarised in section 2 and integrated in section 4. For example, while discussing the role of the private sector and public financial institutions in NBS financing and implementation (in the second workshop, see section 4.2), three NBS financing models -based on existing literature- emerged: private, blended and public. We used these models to summarize some of the key results of the PBF deliberations.

The forum agendas, keynote/presentation abstracts and core questions of the thematic sessions can be found in the appendices at the end of this document. PBF video and audio recordings as well as presentations are available upon request.

4 Results

In this section, we summarise the key results of stakeholder deliberations conducted in the PBF (see section 3 for methodology).

We build on a literature review (see section 2) and on the workshop synthesis documents co-authored by the PHUSICOS team and PBF participants (Scolobig et al., 2020; Scolobig et al., 2021; Aguilera Rodriguez et al., 2022). We also use boxes to highlight selected applications of governance, policy, finance, or capacity-building innovations already implemented in the PHUSICOS concept and demonstration cases or elsewhere (e.g. applications suggested by the PBF members/stakeholders).

We present the results following the key themes addressed in this deliverable, namely: governance and policy; finance and the private sector role and capacity-building.

4.1 Governance and policy innovation for NBS

In this section, we describe the key themes linked to governance and policy innovation for NBS emerged during the PBF deliberations, namely: NBS policies and their implementation, the relationship between grey and green measures, the role of standards and regulations, selected innovations to catalyse NBS policy and governance change and NBS mainstreaming.

4.1.1 NBS policies and implementation

During the workshops, EU policy measures focused on NBS in the DRR/climate adaptation sector. NBS policy instruments in selected Member States were presented and discussed, including the:

- 2007 Flood Directive (EC, 2007);
- 2009 EC White paper on adaptation and Climate Strategy (EC, 2009, EC, 2021);
- 2013 Global Infrastructure Strategy (EC, 2015);
- Water Framework Directive (EC, 2008);
- 2015 Action Plan on the Sendai Framework for DRR (UN, 2015), and
- EU Green New Deal (EC, 2021).

The presentations revealed that many NBS policies at the EU scale are based on ‘soft’ or non-legally binding measures and on voluntary actions (see section 2.1). Although NBS are only starting to emerge as a concept of their own right at the Member State level, they already face some resistance. For example, there is poor application of NBS policies at the local scale (Davis et al., 2018; EEA, 2021). Several international frameworks and agreements explicitly mention NBS or Ecosystem-Based Adaptation/Eco-DRR (e.g. the Sendai Framework for DRR, 2015–2030 and the Paris Agreement), yet they provide little guidance on how to monitor progress on NBS adoption or how to integrate the concept into National Adaptation Plans.

But there are exceptions. The Norwegian “National guidelines for climate and energy planning, and climate adaptation” require NBS to be mentioned as a preferred adaptation solution compared to traditional infrastructure. Thus, if NBS are not selected, the decision should be justified. By switching the burden of proof to traditional solutions and not nature-based solutions, these guidelines promote NBS (see Box 1).

Box 1: National guidelines for climate and energy planning and climate adaptation including NBS (Norway)

In Norway, some requirements specifically state that public authorities must consider NBS when selecting planning, conservation and restoration strategies at municipal and regional levels. For example, this is noted in the regulation “[National guidelines for climate and energy planning and climate adaptation](#)”, ratified in 2018.

In paragraph 4.3 on requirements during the planning process, nature-based solutions (NBS) are explicitly mentioned as an alternative to be assessed along with any grey solution. Further, it is stated that should the NBS be dismissed, the reason must be substantiated. In 2022, the Norwegian Environment Agency published more detailed [guidelines](#) for climate adaptation that built strongly on this regulation. Nevertheless, it should be noted that the implementation of these guidelines is still in its infancy.

Another exception are the Swedish regional action plans for green infrastructure, delivered by County Administration Boards in 2018. The plans do not include any mandatory requirement to deploy NBS but provide guidance on systematic planning processes with respect to green infrastructure at the regional level (Davis et al., 2018).

Finally, it is important to emphasize that the policy landscape is changing rapidly. The inclusion of NBS in the COP 27 decision text is certainly a milestone that could quickly catalyse policy change in several countries (see section 1). As a result, several governments have recently taken a hard look at what is needed to ambitiously scale up NBS, including e.g. the United States of America (White House, 2022). Finally, to support national policy developments and effective NBS implementation, several global standards, and guidelines (e.g. IUCN 2020) have been developed and are presently used to support policy design in several regions and countries. The following sub-sections explore three key topics of governance and policy innovation that emerged in the PBF workshops.

4.1.1.1 Coherence between NBS definitions and funding

Policy innovation by EU Members States is hindered by the adoption of different NBS definitions in national policy instruments.

These differences might show a lack of coordination between initiatives at the EU level and at the national and local levels. (...) Definitions matter and can influence policy decisions on which NBS to implement. For example, do all measures for restoring ecosystems (for DRR purposes) also deliver jobs – see EU definition of NBS – and thus can they be labelled as NBS? Multi-functionality is a key aspect of the NBS definition. Moreover, NBS improve natural functions, create well-being, jobs and are co-designed with stakeholders.

We need to capture the new framing by the EU if we aim at differentiating, for example, traditional ecosystem-based approaches and NBS [Elisa Calliari, University College London].

Definitions also matter because they can serve as ‘gatekeepers’ for NBS funding. For example, should “naturalistic engineering measures” (a term often used in countries such as Italy) to reduce landslide risk be considered nature-based solutions?

Coherence should emerge from funding schemes to force implementation on the ground to follow certain criteria instead of giving total freedom to local authorities to label any kind of measure or no measure as NBS (*ibidem*).

4.1.1.2 Land availability

National or local authorities might hesitate to implement NBS because they are too expensive. One of the main factors making some NBS more expensive than “grey” solutions is the cost of land that needs to be acquired (e.g. river embankments). This raises questions concerning the scalability of NBS.

Limited land availability is a major barrier to scale up NBS projects [Maurane Valdelfener, Grand Lyon].

Land expropriation is an option to implement NBS, but it is very difficult to implement because of opposition by property owners in many countries. Additionally, there are important equity considerations associated with this option (Thaler et al., 2020). For example, there has long been a debate on purposefully flooding upstream land to protect land downstream, and how landowners should be compensated for sacrificing their land (Loschner et al., 2019). A study in England and Wales showed that financial compensation remains the main driver for landowners to agree to flood storage schemes (McCarthy et al., 2018).

4.1.1.3 Inclusive bottom up NBS planning: last or first mile?

Collaboration and multi-stakeholder engagement are critical to promote inclusive and bottom up NBS planning.

NBS projects are not reaching the scale that would be interesting to large investment flows, particularly climate finance flows. Their planning is not as inclusive and bottom-up as it is going to need to be to produce such scaled projects with key groups such as farmers and local communities [Louise Gallagher, University of Geneva].

Inclusive, participatory, and bottom-up NBS planning is thus deemed a key catalyst of governance innovation. An example of NBS co-design in Italy implemented during the PHUSICOS project is described below (see Box 2).

Box 2: A living lab for NBS co-design in the Serchio River Basin (Italy)

An innovative governance approach adopted by the PHUSICOS project in the Serchio River Basin in Italy was the bottom-up participatory process/living lab in which farmers and local organizations closely collaborated with the responsible authority, the Autorita' di Bacino Distrettuale dell'Appennino Settentrionale (ADBS) to select the appropriate NBS interventions. The alignment between citizen and decision maker preferences facilitated the identification of the most suitable NBS for the area and established a relationship of trust. With a sense of involvement, the farmers were willing to actively participate. As a matter of fact, the local farmers from the watershed took responsibility for the vegetative buffer strips on their land by reshaping the canals and planting native species to prevent sediment and pollutant runoff into Lake Massaciuccoli. For this to happen, an innovative payment scheme for ecosystem services was put in place. Farmers received compensation for implementing the buffer strips, which benefited both the farmers and, as a public good, the whole region (see also Box 11). The measures not only improve the water quality of the lake and mitigate flood risk, but also reduce field erosion. Moreover, the farmers can sell the harvested crops from the buffer strips as animal feed. Interestingly, farmers were sceptical at the beginning, possibly as a result of over 20 years of top-down decision-making, including agricultural subsidies. Once the farmers found themselves at the centre of implementing the measures, they fully supported the NBS co-design. Close cooperation will likely continue for monitoring and maintenance. Governance innovation was fostered not only by the collaboration between farmers and public agencies but also between public agencies and research organisations. Indeed, researchers at Pisa University identified the specific characteristics of the seed species necessary for realizing the buffer strips.

Given the potential demonstrated by the project, the ADBS intends to scale up these solutions as best practices at the regional (Region Toscana) and national level. For this to happen, however, it is necessary to increase NBS regional and national funding, e.g. by explicitly including NBS in rural development and water/flood risk management plans. Two key catalysts to foster this inclusion are the availability of NBS effectiveness evaluations and official recognition of NBS benefits and co-benefits. Also, since NBS do not have the same characteristics of grey/structural measures, procedures for NBS approval should be simplified. For example, technical self-certification schemes from the authorities in charge of NBS implementation can be promoted.



Figure 1: Ground preparation along one of the canals before seeding (Source: ADBS, 2021).

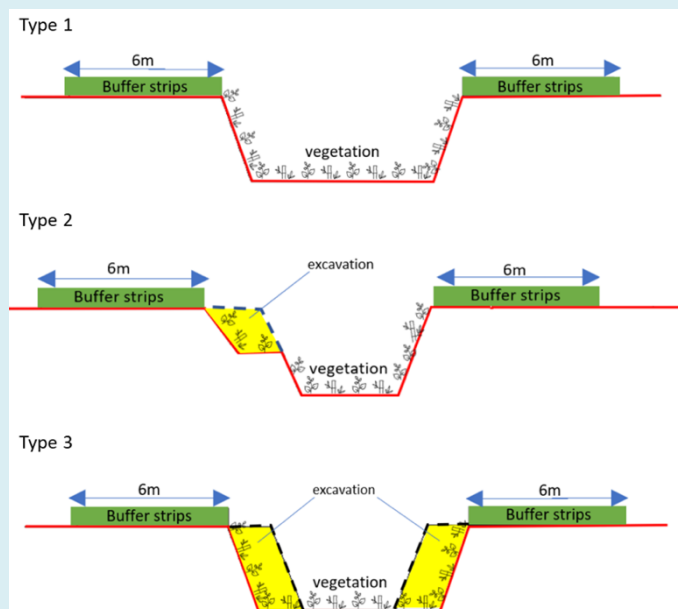


Figure 2: Sketch showing three different ways of modifying the canals (Source: NGI, 2023).



Yet, as reported by Davies et al. (2021), NBS co-design and stakeholder engagement is not always un-problematic. Trade-offs and conflicts can originate because of competing planning goals and socio-economic objectives as well as conflicting perspectives/values held by different stakeholders (Depietri, 2022; Scolobig and Gallagher, 2021; Linnerooth-Bayer et al., 2015). Trade-offs may occur, for example, when seeking biodiversity conservation that conflicts with human well-being goals. For example, in the city of Linz, Austria (Davies et al., 2021), NBS aim to enhance and protect urban green spaces for biodiversity conservation, but at the same time they have generated conflicts with new development and housing aiming to improve social well-being. Additionally, NBS might generate inequities associated with how the costs and benefits accruing from NBS initiatives are distributed among the local population (Toxopeus et al., 2020).

4.1.2 Green vs. grey solutions

The unbalanced distribution of funding for green and grey measures, as well as “green washing” are key problems hindering NBS implementation. These issues were discussed multiple times during the PBF deliberations. Below we provide a summary of the key points discussed.

4.1.2.1 *Green vs. grey funding streams and approval procedures*

NBS implementation is hindered in part by the inequity in distribution of funding:

Not a lack of funding for NBS but the unfair distribution of funding for green and grey measures. For example, in the same river basin, funds allocated to grey infrastructure vs. NBS could differ by several orders of magnitude [Andrea Goltara, Centro Italiano per la Riqualificazione Fluviale, CIRF (Italian Centre for River Restoration)].

Generally, grey measures receive more funding than green ones (Browder et al., 2019; Ozment et al., 2019b), and local authorities often lack strong political incentives to implement NBS. Moreover, their respective funding streams are often separate. This also translates into a bureaucratic difficulty for NBS and hybrid projects, as different funding schemes and practitioners and professionals need to be approached and coordinated across different sectors.

Additionally, approval procedures often pose unsurmountable burdens for NBS implementation because of the costs incurred and other difficulties. There are ways to overcome such difficulties, however, and creative and innovative solutions should be envisaged (see Box 3).

Box 3: Dam classifications in the Gudbrandsdalen case (Norway)

“The measure proposed for the tributary river Skurdalsåa in the Norwegian demonstrator case site Gudbrandsdalen is the improvement of a small retention dam. This measure falls under the Norwegian regulations for dam classification, potentially invoking a framework of regulations for management and inspection. Norwegian dams are classified into five classes (0–4), with increasing safety requirements for higher classifications. All classes except the lowest (0) require annual reviews, including physical inspections. This will have a high annual cost to be carried by the dam owner. The owner at this site is a small private association comprising the local landowners (farmers) along the river and the lake, and this association cannot cover the annual inspection costs. The implication of this is that the measure will not be implemented if the re-vitalized dam is classified as anything other than a “Class 0 dam”. There are hundreds of similar dams in the catchments in Gudbrandsdalen and other Norwegian valleys, most built 100 to 200 years ago. A successful project in Skurdalsåa would have great potential for upscaling to include similar dams. Hence, regulations made for modern dams mainly for hydropower purposes are not suited for regulating small adjustments (often improvements) of the existing small dams, which, if updated, could provide efficient flood retention without the necessity of large new measures downstream.”

Source: Solheim et al., (2021: 14)

To overcome other challenges linked to NBS implementation, simplified NBS approval procedures are often advocated. An example cited by workshop participants is a technical self-certification from the public authorities in charge of NBS implementation. For several participants, this could help accelerate the conversion from grey to green:

Some companies that now build grey measures will inevitably convert to green ones. The same transition already happened several times in the past, e.g. when engineers moved from reinforced concrete to steel. Yet, hybrid or grey solutions may still remain the best options in several cases [Nicola Del Seppia, Serchio River Basin Authority, Italy].

4.1.2.2 Green washing

Another problem, as expressed by one of the participants, is ‘green washing’ (see box 4 for an example of a prevention of an instance of greenwashing).

In contrast to grey measures, which are often large and visible, NBS are typically less impressive and thus difficult to communicate. NBS are often used as green washing in projects that are hybrid or primarily structural/grey [Luca Pucci, Legambiente NGO].

Box 4: NBS and greenwashing: a case from the Pyrenees

The Catalonia Railway Administration (Ferrocarrils de la Generalitat de Catalunya, FGC) put forth a proposal to PHUSICOS partners in the Pyrenees demonstration case for enlarging a car park that would accommodate increased traffic to the Port Ainé ski resort in the town of Rialp. The additional parking space would have used green and sustainable techniques, such as:

- Maintaining vegetation as much as possible in the parking area;
- Minimizing rockfill and integrating the parking space with the landscape around it to the extent possible;
- Stabilizing using local wood, avoiding long transport and using sustainable building techniques instead of designing “grey structures” like concrete walls; and
- Keeping the use of rock gabions and steel structures to a minimum.

While using more natural materials to integrate the carpark in the landscape is an improvement over a purely grey solution, it raises a difficult issue. When do hybrid NBS solutions become predominantly ‘grey’ solutions – what has been termed ‘greenwashing’? Indeed, one major criticism of [current NBS frameworks](#) (e.g. IUCN 2020) is their alleged ambiguity and the potential for greenwashing.

In this case, the proposal was rejected by the PHUSICOS steering committee. In the words of one commentator: “Surely a carpark only increases the number of people reaching the slopes by car, all in all not increasing sustainability. The proposal does read a little bit like ‘greenwashing’ of a carpark that was anyway needed in the area” [Steering Committee, PHUSICOS].

4.1.2.3 Divestments from grey infrastructure and nature-negative projects

A common perception throughout the EU, and in some countries more pronounced, is that green infrastructure is not as effective as grey infrastructure. Martin et al. (forthcoming) show that scepticism towards the performance of NBS vs. traditional infrastructure was found to be an important barrier to NBS implementation. Some countries might attribute a high value to urban green spaces than other countries and different perceptions of nature will thus inevitably be translated into different regulations across countries. Thus, a paradigm shift is needed for NBS to be able to compete with other land uses. If nature-based solutions are considered as critical green infrastructure, it will be more difficult to convert these areas to other uses, e.g. residential housing. Attention should thus be focused on showing the cost-effectiveness of NBS and, often, their superiority in comparison to “grey” solutions.

The paradigm should shift towards making a “negative business case” for grey solutions. NBS always have to prove their superiority vs. grey solutions (...) but why don’t we do the same with grey [Juraj Jurik, Global Infrastructure Basel Foundation]?

This switch is in line with advocacy to enable divestments from nature-negative projects, as presented below (see Box 5).

Box 5: Task Force on Nature-related Financial Disclosures

To better enable firms and financial institutions to understand their impacts on nature, a Task Force on Nature-related Financial Disclosures has been established, supported by Global Canopy, the United Nations Development Programme (UNDP), the United Nations Environment Programme Finance Initiative, and the World Wide Fund for Nature (WWF) (Calliari et al., 2022). At the European level, the European Commission is developing a legislative package for a regulation on sustainability-related disclosures, which will include an EU-wide taxonomy/classification system for the sustainability of investments (EU Technical Expert Group on Sustainable Finance, 2020). To date, however, divestment from climate-negative assets is fully voluntary, yet incentivized by investor and business concerns about their public image.

Mandatory enforcement mechanisms may also be called for. For the banking sector, this could come in the form of strict divestment procedures initiated at the European Central Bank (ECB), which would extend its mandate beyond its current focus on financial stability, or in the lending policies of the European Investment Bank (EIB) and European Bank for Reconstruction and Development (EBRD). Both public banks are moving strongly towards sustainable investment. The EBRD, for instance, has embarked upon a Green Economy Transition 2021–2025, but its ability to offer loans for NBS may be constrained by its private sector-oriented business model. What stands apparent is the necessity to transition the governance of the financial sector, including public banks, such that they can provide the financial capital necessary to meet European nature targets (Calliari et al., 2022).

4.1.3 NBS standards and regulations

The lack of formal standards and regulations is increasingly recognized as a barrier to the design and implementation of NBS. In this section, we address the key gaps preventing public authorities from addressing these barriers.

4.1.3.1 NBS long-term performance and comparability

There are still sizeable knowledge gaps concerning the demonstration of transferability, effectiveness at larger scales and quantification of co-benefits of NBS (Chausson et al., 2020; Calliari et al., 2019), especially their socio-economic benefits and other co-benefits. For example, the health and well-being benefits of NBS are frequently referenced, yet knowledge concerning NBS impacts on mental and physical health, quality of life and social cohesion remains fragmented (see also Calliari et al., 2022).

A particular challenge is embedding NBS multifunctionality in the assessment of adaptation options (UNEP, 2022a). Developing better assessment frameworks (Autuori et al., 2019) that can support policymakers in choosing among NBS, hybrid or more traditional/grey solutions can play an important role for wider NBS uptake.

It is critical to provide better NBS assessments. Three pre-conditions to implement NBS are particularly relevant. First, verifiability, to demonstrate

robust track records (monitoring performance over time, achieving design criteria). Second, predictability, especially of NBS long-term performance and effects. Third, comparability, for NBS to be functionally comparable under varying conditions (e.g. geo-zones) and with grey solutions [Fredrik Mink, Independent consultant, Advisor EU Dredging Association].

Another key gap lies in the monitoring and evaluation (M&E) of NBS for DRR (and adaptation). To date, many initiatives on the ground have failed to set up M&E systems that can adequately capture outcomes of NBS projects, let alone impacts [Sylvia Wicander, UNEP World Conservation Monitoring Centre].

Another important issue is that NBS assessment also plays a critical role in liability for damage compensation for (e.g. flooded) private property in the DRR context. The bearer of responsibility for the potential success or failure of an NBS to reduce disaster risk needs to be carefully defined to avoid potential legal complications (see section 4.3.5).

These barriers to NBS mainstreaming are addressed in more detail in PHUSICOS deliverables 5.2 (Martin et al., forthcoming) and 5.4 (Linnerooth-Bayer et al., forthcoming). A comprehensive framework for NBS assessment is also provided in PHUSICOS deliverable 4.1. (Autuori et al., 2019).

4.1.3.2 NBS multifunctionality, standards and regulations

While there is increasing recognition of the value and benefits of NBS, the lack of and need for assessment frameworks to quantify their co-benefits is also repeatedly cited (Cohen-Shacham et al., 2019; EEA, 2021; Nesshöver et al., 2017). Additionally, standards and guidelines for implementing NBS are still insufficiently developed (Sowińska-Świerkosz & Garcia, 2022). Standards are clearly defined for grey solutions, but for green solutions, it is more difficult for companies to foresee and prepare for the challenges that NBS can bring and therefore to calculate and generate revenue. Vincent Farrelly, founder of AquaRoot Technologies, explained how the lack of NBS criteria (along with other factors) affects the procurement process for nature-based enterprises:

Managing expectations of the customer is complicated. There are things you can do that are sustainable, then there are things that you cannot do, and if you want to get to sustainability, it can be extremely expensive, and also the performance criteria may be lacking compared to a non-sustainable item [Vincent Farrelly, AquaRoot Technologies].

Standards define the prerequisites necessary to ensure a level of quality or performance and can serve as a basis for assessing compliance or quality, therefore guiding those responsible for their implementation in the field. Standards set out the necessary specifications, conditions, and procedures to be followed, providing a common language and greater certainty to both suppliers and demanders. With quality standards, well-designed and procured NBS would be rapidly scaled up, based on already available experience and frameworks.

The IUCN Global Standard for NBS (2020) is one of the most prominent frameworks at the international level. The standard has potential to help distinguish NBS projects from other similar initiatives and provides a simple tool for practitioners to improve the

quality of NBS. The IUCN NBS standards include eight criteria and 28 indicators for designing new or evaluating existing and past solutions. Yet, due to the wide range of actions that are covered under the NBS umbrella, the design of standards for specific types of NBS was deemed necessary. The identification and use of other already available guidelines and standards that might be applicable (e.g. guidelines for forest restoration or for the implementation of ecological disaster risk reduction measures) can also be valuable. In all cases, tools must be accompanied by capacity-building and be measurable, assessable, and monitored.

Finally, standards can also serve as the starting point for NBS to be integrated into regulations (e.g. land-use plans, building codes, etc.), ensuring not only their broader use, but also their long-term sustainability. A shift towards the inclusion of NBS in regulations would, however, require further work and evidence to assist the transition. Currently, distinguishing the applicable (often contradictory or clashing) regulations for NBS is cited as a challenge in project execution:

In terms of barriers, NBS cover many topics, so it is sometimes difficult to see which law is applicable, if it is biodiversity, water protection, natural hazard risk prevention, etc. So, the coordination can be difficult [Nathalie Nyssen, Firmenich].

4.1.4 Catalysing NBS policy and governance innovation

Four main areas have been identified to promote NBS policy and governance innovation: promoting mandatory instruments in European policies, reducing policy fragmentation and encouraging synergies, merging planning and implementation, merging green and grey funding streams and empowering the local level. These are explained further below.

4.1.4.1 Promoting mandatory instruments in European policies

Many NBS policies at the EU level are currently based on soft measures that are not legally binding (Davis et al., 2018; EEA, 2021; Calliari et al., 2022). Thus, most of this NBS support is made up only of voluntary actions at the State level. EU support remains weak for policy financing and implementation. As noted by participants, mandatory instruments should therefore be promoted.

One example is enforcing a certain land proportion of forest cover for each Member State [Juraj Jurik, Global Infrastructure Basel Foundation].

As previously noted, the new Nature Restoration Law marks a critical step towards overcoming this lack of enforceable instruments (Directorate-General for Environment, 2022; see section 2.1). Likewise, the Common Agricultural Policy (CAP) plays a crucial role in enforcing NBS targets because it represents a considerable budget item in the EU agenda. The CAP could be a window of opportunity to better enforcement of NBS funding allocation rules.

For example, in the CAP, conditionality has worked in the past. It should be transferred from national to European scale. Conditionality can include measures at the small scale – like buffer strips – that can increase effectiveness at the large scale [Andrea Goltara, CIRF].

Accordingly, conditionalities established by CAP financial incentives can help promote NBS measures that contribute to CAP goals.

4.1.4.2 Reducing policy fragmentation and fostering policy synergies

The plethora of NBS policy domains and instruments has resulted in policy fragmentation and a lack of coordination between agencies in charge of NBS design and implementation in different sectors (EEA, 2021). Such patterns can be observed also in the policy domain of forestry, for example (Aggestam & Giurca, 2021). There are several options to reduce policy fragmentation, including the development of an overarching steering instrument that could establish a pathway for clear NBS policies at the Member State level. There also exists potential to build policy synergies, for example, by linking NBS policies to other policies such as in well-being and preventative health care, green infrastructure, transport, and mobility. Cross-sectoral integration of NBS and related concepts is also key to generating concrete implementation actions.

Yet, reduction of policy fragmentation does not come without consequences, some of which could be negative. Creating “one-size-fits-all” approaches may reduce fragmentation but could also reduce variation in implementation contexts and therefore the potential for experimentation and learning.

Moreover trade-offs cannot be overlooked. They may, for example, occur when seeking to achieve biodiversity conservation that conflicts with human wellbeing goals, such as promoting NBS while providing opportunities for new development, housing or parking. Identifying potential trade-offs between different policy goals is important to move the NBS policy agenda forward.

4.1.4.3 Merging responsibilities for planning and implementation

NBS budgets are often managed by different actors than those involved in NBS planning and implementation, a division of labour aiming to increase accountability and reduce conflicts of interest and collusion. For example, coordinating agencies such as river basin authorities aim to contribute to greater cooperation amongst actors involved in the planning and development of river restoration projects. However, such coordinating agencies often do not have the financial means necessary to implement their projects. Their action and potential will be limited due to this separation of activities. This is the case for many river basin authorities across Europe. Improving coordination between the multiple authorities that are benefiting from NBS is critical:

Indeed, it is not always the case that NBS are cost-effective at an intervention-based level, it's at the co-benefit level that financial benefits of green over grey measures are evident [JoAnne Linnerooth-Bayer, IIASA].

4.1.4.4 Merging green and grey funding streams at EU and national level

A lack of balance between funding for green and grey solutions was highlighted. Funding streams for green and grey measures are also siloed, entailing several consequences. This complexity of the funding landscape does not make it easy for local authorities to favour NBS over “grey” measures for DRR.

One solution to this issue would be to merge these conflicting funding streams into a single DRR programme which prioritizes NBS approaches [Andrea Goltara, CIRF].

4.1.4.5 *Empowering the local level*

As previously seen (see Section 2.1), the European Commission is significantly investing in NBS and green growth (Faivre et al., 2017). However, local empowerment is not being addressed.

There are limited guidelines to support NBS implementation at small scales. This leads to the growth of single and isolated solutions that are not strategically planned and integrated at larger scales. National policies should boost a multi-level integrated approach to design and manage NBS systematically across the territories to also be more effective for DRR purposes [Andrea Staccione, CMCC].

Participants agreed that developing strategic plans (e.g. climate and/or biodiversity plans) that aim to empower the local level and support integrated local actions is a priority. A good practice example is illustrated by the “Resilience Office” in Milan (Italy), set up with the assistance of the Rockefeller Foundation. The role of this office is to coordinate between different departments and agencies to find the best solutions to increase the city’s resilience. Another good practice from a different sector, is the previously mentioned EU Farm to Fork Strategy (EC, 2020), which was built after extensive public consultation.

NBS hubs may be an effective model, at local or regional level. These hubs act as catalysts for NBS adoption, they may ideally include a university or research institute, solution providers (it can be businesses or local authorities) and NGO/civil society representatives [Juraj Jurik, Global Infrastructure Basel Foundation].

4.1.5 NBS mainstreaming

Barriers, opportunities and challenges to NBS mainstreaming were also discussed and included the following insights.

First, countries have diverse NBS governance systems. We can learn from good practices from all of them, especially concerning sometimes novel horizontal and vertical governance structures (e.g. making room for rivers in the Netherlands, for which new forms of collaboration were institutionalized). By harmonizing governance procedures and funding opportunities, new markets can emerge for the private and financial sectors. A long-term perspective on NBS is needed, since many NBS are not cost-effective in the short-term. We thus need more long-term financing arrangements, which can be catalysed by involving both financial institutions and public authorities.


Second, collective efforts are needed for NBS to become the first and easiest-to-implement choice in risk management plans (e.g. those derived by European Directives such as 2000/60/EC and 2007/60/EC). For example, in Norway, the 2018 “National guidelines for climate and energy planning and climate adaptation” explicitly mention

NBS as an adaptation solution. This regulation states that, if NBS are not selected, that decision shall be justified (see Box 6). These guidelines are voluntary, however, and not mandatory.

Third, fostering open discussions at local levels about long-term and systemic benefits of NBS can facilitate their adoption and mainstreaming. Even when NBS financing is available, there can be regulations that block their implementation. Possible reasons can be limited space availability or competing regulations regarding the preservation of cultural heritage, which may pose serious challenges for NBS scaling. Thus, there is a need for open discussions with decisionmakers on urban planning priorities (e.g. with flood ways or vegetated slopes).

A way to mainstream NBS finances is to have an open discussion in the city about NBS long-term and systemic benefits. This is about adopting a new way of thinking to address climate and biodiversity crises jointly [Sergio Castellari, Italian National Institute for Geophysics and Volcanology].

Box 6: Regional plan for the Gudbrandsdalslågen and its tributaries (Norway)



The Lågen plan
Regional master plan for the Gudbrandsdalslågen and its tributaries
- Measures to reduce damage from flooding and landslides

Adopted in 2018 and commonly known as “The Lågen plan”, the regional master plan for the Gudbrandsdalslågen and its tributaries was developed by Norway’s Innlandet County Authority (formerly Oppland) in response to a long history of flood events. The 2011 and 2013 floods had caused massive and costly damages. The plan was an innovative approach to meet the challenge of a changing climate and more extreme and frequent weather events and is based on a comprehensive knowledge base. The plan consists of a set of guidelines and recommendations that serve as the basis for the planning, use and protection of areas vulnerable to flooding and landslides with the objective of protecting the lives and livelihoods of communities.

Figure 3: Cover page of the Lågen plan (Source: Innlandet County Authority, 2018)

The Plan highlights measures that can help limit potential damage from natural hazards while safeguarding water-related assets and nature (Innlandet County Authority, 2018). From sediment removal, recommendations for measures in

agriculture, forestry, waterways and roads to advice for cooperation and for changes in national frameworks, the plan embraces a cross-cutting and integrated view of the problem.

From its earliest stage in 2013, under the auspices of Innlandet County, the plan brought together a wide range of stakeholders in a highly participatory process including road authorities, railway authorities, all county municipalities, the County Governor, the Norwegian Water Resources and Energy Directorates, NGOs, and a farmer's association. This process was particularly beneficial to PHUSICOS for its activities by building both on the collaborative environment and previous studies that had identified priority locations (PHUSICOS, 2019).

Fourth, participants highlighted other opportunities to enable NBS. Working on multiple governance levels linked to NBS politics and policy is one example. Political will was considered critical; especially because trust in NBS and their performance is still lacking (see Box 7). Additionally, NBS experts working with and for public authorities are scarce. Engaging a diverse range of stakeholders, including natural scientists, bankers and insurers, has been regarded as a recipe for successful NBS implementation. This once again emphasizes the importance of cross-sectoral partnerships and multi-disciplinarity (Juraj Jurik).

In the performance of NBS, trust is still not there, and public authorities often do not have experts in this field. So, having a good mix of stakeholders, from hydrologist to experts in finance and insurance is a recipe for success. Without this kind of expertise, it is very hard to succeed [Juraj Jurik, Global Infrastructure Basel Foundation].

Box 7: Trusting relationships with local decisionmakers in the Pyrenees (Spain and France)

Participatory co-design of NBS been one of the approaches adopted by the PHUSICOS project and has thus been visible in the PHUSICOS demonstration sites.

In the Pyrenees mountain range, NBS are being implemented in Santa Elena and Erill-La-Vall in Spain, in Artouste and Capet in France. The lead coordinators, the Working Community of the Pyrenees (CTP) and the Pyrenean Climate Change Observatory (OPCC), engaged with multiple stakeholders from the early stages to establish fruitful dialogues. Strategies, funding plans and monitoring arrangements for each site were jointly designed, building a trusting relationship. This process of co-design is generally agreed as a means to increase the likelihood that NBS are well maintained, continued and replicated in other sites. On all four sites, local mayors were closely involved and championed NBS. This was particularly evident on two sites. In Erill-La-Vall, Spain the interest in NBS and risk reduction generated by PHUSICOS in the region prompted the municipal government to consider the development of a disaster risk management plan for the valley to better address the risks generated by debris flows from nearby gullies. Meanwhile, in Capet, the studies carried out by the project partners enabled the public administration in charge of forest and risk management to improve their work and

sampling protocols for soil protection and conservation. In the Artouste region, local authorities responded positively to the establishment of the Artouste-Laruns experimental site where the NBS are being tested to prevent rockfalls, and they plan to continue and promote the measures. In addition, the site has attracted great interest from the scientific committee of the Pyrenees National Park. Finally, in Santa Elena, where the project targets the reduction of soil erosion and rockfall risks, the measures have been designed with the participation of the Polytechnic University of Madrid (UPM), a national leader in forest management, timber structure design and forest protection against natural hazards. In view of the significant interest in the site across the region, several educational visits have been organized for students from forestry universities, vocational training in forest nurseries and landscape gardening.

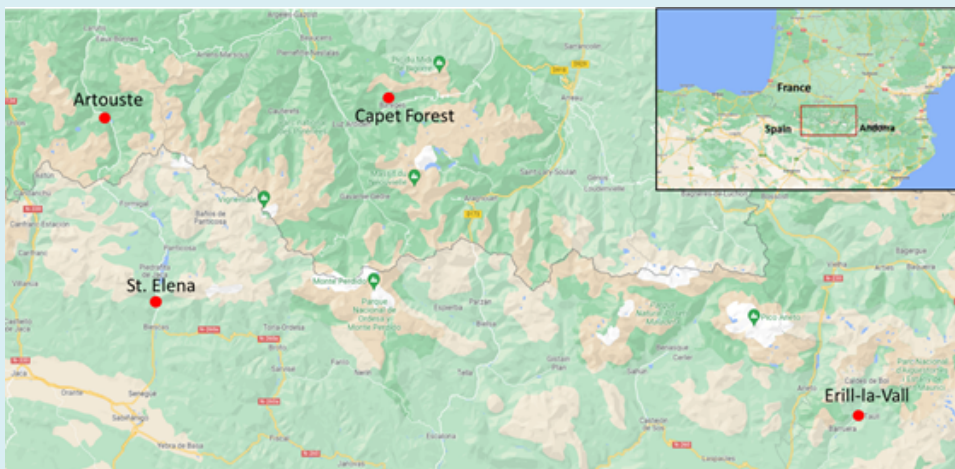


Figure 4: Map showing the location of the PHUSICOS interventions in the Pyrenees (Source: NGI, 2023).

Fifth, participants argued that radical shifts might be needed to reform and green existing policies such as the CAP. Likewise, long-term policies were considered prerequisites for mainstreaming NBS, since these solutions require long-term maintenance and continuity.

You always need to consider that some NBS need maintenance, and they need continuity, so they get better. You need value chains. So, policies need to be quite stable and move in a good direction e.g. by making it really attractive for landowners to have (...) good NBS [Gerd Lupp, Technical University of Munich, Germany].

4.1.6 Summary

In this summary, we provide an overview of the key points on policy and governance innovation from section 4.1.

Mandatory policy instruments: To date, many EU policy mechanisms enabling NBS remain voluntary and thus have no legal obligations to comply. Mandatory policy instruments, e.g. making NBS compulsory elements of landscape planning, could be further promoted. An example is the protection of a proportion of land for forest cover in EU Member States as in the proposed EU Nature Restoration Law.

Standards: Clear formal standards are an increasingly recognized key element in guiding the design and implementation of NBS. By outlining a set of evidence-based criteria, standards assist in ensuring the quality, safety and efficiency of interventions while supporting their long-term sustainability and minimizing the possibility of unwanted social and environmental impacts. In some cases, given the contextual sensitivity of NBS, tailored standards for specific types of solutions may be called for.

Co-benefit evaluation: Implementing new NBS policies within Member States is essential to promoting the NBS agenda. Yet, the quantification of co-benefits, proof of NBS transferability and effectiveness at larger scales all need to be further researched to back up the promotion of such laws and regulations. This information can be used within innovative methods to improve the visibility of NBS investment co-benefits for regulatory and funding decisions. Until tools for co-benefit quantification are available, qualitative targets can be used. While this does not solve the numerous challenges related to the difficulty of quantifying non-market benefits and interconnected impacts, qualitative targets would provide decision-makers with much-needed evidence on the viability of NBS.

Policy synergies and trade-offs: There is potential to link NBS policies to other policies related to well-being and preventative health care, biodiversity, green infrastructure, transport and mobility. Cross-sectoral integration of NBS and related concepts is key to generate concrete implementation action. One integrated NBS policy example could be the co-development of joint biodiversity and climate plans at regional or national level. However, trade-offs will occur and cannot be overlooked. For example, when seeking both biodiversity conservation and human wellbeing goals simultaneously, such as promoting NBS while providing opportunities for new developments such as housing.

Integrated and inclusive bottom-up NBS planning: There are few guidelines to support NBS implementation at small scales. This often leads to a growth of single and isolated solutions that are not strategically integrated on a larger scale. This is problematic because NBS often require extensive and expensive land acquisition on a grand scale. To address this challenge, integrated and inclusive bottom-up NBS planning should be promoted systematically. Innovations to empower the local level include NBS knowledge hubs, close collaboration with NBS project ambassadors/local champions, and promotion of cross-sector and cross-scale institutional mechanisms.

Divestments from grey infrastructures and nature negative projects: The unbalanced distribution of funding for green and grey measures, as well as green washing, are key problems hindering NBS implementation. Developing policy instruments that allow to divest from grey infrastructures would help to overcome this imbalance. One reported example is encouraging or even requiring financial institutions to divest from nature-negative activities and to invest in nature-positive activities. This would redirect large amounts of financing to NBS. However, there must also be

transparent ways to identify nature-positive solutions without greenwashing. Despite the need to divest from grey infrastructures, in some cases (especially when life losses are at stake) hybrid or grey solutions may still be the preferred options to guarantee high security standards.

Green and grey funding streams and land acquisition: Although the capital costs of NBS can be less than for grey infrastructure, there are still significant costs in their implementation including expensive land acquisition, which make upscaling difficult. This could be addressed with innovative funding mechanisms (e.g. Payment for Ecosystem Services). The lack of balance between funding for green and grey solutions, due in large part to separate funding streams, further complicates matters. One possible solution is to merge complementary funding streams into single programmes (e.g. disaster risk reduction plans or water management plans) that prioritize NBS approaches.

4.2 Public, private and blended financing models

While discussing the role of the private sector and public financial institutions in NBS financing and implementation, three NBS financing models emerged: private, blended and public. We use these models to summarize some of the key results of the PBF deliberations.

4.2.1 Private financing

Private firms are more likely to choose to invest in NBS if the value of the direct benefits to the enterprise outweigh the investment costs. Several cases of private financing were discussed, including:

- A privately-owned hydropower plant facing large costs in removing sediment from its water reservoir can plant trees on the adjacent slopes to reduce sediment flow into the reservoir, which can have large benefits for the enterprise;
- A private electric company can greatly reduce the maintenance costs on its distribution lines (mainly mowing vegetation under the lines) by planting low-maintenance vegetation that also creates diverse habitats;
- A private company can invest in the renewal of wetlands next to its facilities by planting native shrubs and trees, restoring native habitats for local fauna and reducing flood risk to its facilities.

4.2.1.1 *Barriers to private financing*

The above cases illustrate examples to pursue NBS if the cost savings outweigh investments. Private individuals or entrepreneurs might then fully finance NBS with their own capital or with credit from a private or public bank such as the EBRD or the EIB. Participants noted that the key barriers to private financing include a lack of information on NBS effectiveness, unfavourable regulations, lack of awareness on behalf of businesses, and path dependency and difficulties in shifting norms and culture from traditional grey solutions to NBS.

Uncertainty in the effectiveness of NBS is a formidable barrier for private investment in NBS infrastructure. In the words of one of the presenters:

There is a tendency for the traditional engineering mindset to go for the solution that is known and tried and tested, and there are more risks with developing NBS because there is a lot of potential for them to fail and these are quite large investments. There is also the need for tried and tested approaches that can embody evidence to prove that these projects will actually deliver on the challenges [Sarah Duff, EBRD].

4.2.1.2 NBS co-benefits

The private sector might also prioritize and fully finance NBS even if the benefits do not accrue to the business itself, as they do in the above examples, but to beneficiaries who are willing to pay for the generated amenities or services. In other words, the firm will finance NBS if it can capture a revenue stream that will cover its costs and provide a return on its investment. An example is a wildlife park that charges for admission. The benefits of the park may go beyond user enjoyment to providing supporting services (e.g. pollinators), provisioning services (e.g. drinking water), regulating services (e.g. climate regulation) and cultural services (e.g. cultural heritage). In the case of the previous example of the hydropower plant, the owner of the adjacent slopes might charge the plant for forestation as Payment for Ecosystem Services.

4.2.1.3 Innovative financial instruments and profitable NBS investments

Participants highlighted that some barriers might be overcome by deploying innovative financial instruments to de-risk projects (e.g. insurance and provision of guarantees). One participant pointed to the potential for downstream residents to pay for an upstream NBS to reduce their flood risk, a payment that could be compensated by a reduction in insurance premiums. Another innovation is the so-called 'resilience bond', i.e. a variation on green bonds that seek to raise capital specifically for climate-resilient investment. More precisely, these are a form of catastrophe bond that links insurance premiums to resilience projects in order to monetize avoided losses through a rebate structure.

It is very important to know what the specific performance of NBS assets is. Knowing that the insurance sector can also ensure performance is very important, not only for the public sector stakeholders, but also for private sector players [Juraj Jurik, Global Infrastructure Basel Foundation].

When there is a profitable revenue stream, private companies may fully finance NBS initiatives by obtaining loans from private or public banks such as the EIB, which is reportedly currently looking for profitable or 'bankable' projects. Participants also commented on the possibility of leveraging NBS through offset markets (e.g. carbon, biodiversity), which allow companies to meet their carbon reduction targets by investing in green initiatives aimed at carbon reduction or elimination.

The EBRD has a particular interest in bankable NBS investments. The EBRD mandate dictates that it provides credit for projects that anticipate a positive economic return. As a public bank, its challenge is to orient its private sector business model with its

ambitious new Green Economy Transition approach (2021–2025). The Green Economy Transition sets a target green finance ratio of more than 50% by 2025. As pointed out by Sarah Duff, the Bank will try to overcome practical barriers to private investment by providing support in project preparation and implementation as well as policy work in countries of operation. Indeed, the [EBRD](#) was the first financial institution to issue a resilience bond. Enabling private NBS investment will maintain an important role alongside the Bank’s financing activity.

Other NBS financing options with the power to directly help NBS contractors to grow and acquire skills are through accelerator projects [e.g. World Resources Institute accelerators], the continued implementation of European financial instruments such as Horizon Europe, and research and development programmes. As noted by participants, small and medium enterprises with the possibility to access funding can serve as lobbyists or advocates of NBS after gaining experience and linking NBS to attractive business opportunities. To this end, feasible timeframes and, as described above, support for contractors to enhance their project planning and proposal design capabilities are required.

Katrin Hüsken, working for BUND Deutschland e.V. and Friends of the Earth Germany, pointed out that many of the funding mechanisms are country-specific, citing that in Germany:

We are trying to find ways to implement NBS, or to find ways where we could add on the solutions to other funding mechanisms. Because in the new funding period, a lot of R&D is going to be funded, there is going to be funding for private-public partnerships or partnerships between universities and the private sector [Katrin Hüsken, BUND Deutschland e.V. / Friends of the Earth Germany].

Discussions also touched upon the need to adjust the financing cycle of NBS projects. Indeed, NBS interventions operate differently than grey alternatives; in most cases they require a longer timeframe to mature and deliver benefits. Restoration projects, for example, are found to require between 10 and 15 years with considerable on-going maintenance efforts before they can produce a long-lasting impact. Considering the monitoring and maintenance requirements and clearly defining the corresponding budget early in the process is essential; a lack of maintenance may negatively impact the performance of NBS, affecting the perception and acceptance of the measures for future projects.

4.2.2 Blended financing

For many NBS investments, private investors find it difficult to capture revenues that generate a sufficient return on their investment, thus limiting interest from traditional financial institutions. At the same time, as shown in the above examples, many NBS generate benefits beyond those that a private investor will receive. The above examples – the forested slope for erosion control, the transmission line vegetation, and the green flood protection measure – each potentially provide co-benefits to the public, such as biodiversity conservation, carbon sequestration, aesthetic value, health impacts, and more. Because of these co-benefits, ‘knock-on effects’ or, in economic jargon, ‘positive externalities’, the public has a legitimate role in co-financing NBS, which is often

referred to as ‘blended’ finance. The participants noted promising co-financing options that provide incentives to private investors, including subsidies and tax rebates for NBS investments.

We need a blended finance strategy to get the private sector on board. The transaction costs of NBS, and the transition risks are far too high to expect that the private sector will be there from day zero, right? But if we have this plan, a 5-, 10-, 15-year plan, and we increase their participation [and] we can get to work in a market that wouldn’t need subsidies anymore and so on. But we need the coordination of interventions and instruments of different actors [Monica Altamirano, Deltares and World Association of Public-Private Partnership units and professionals].

New models of cooperation between the public and private sector can be instrumental to implement NBS in the future.

There is also a need to better motivate collaboration between the public and private sectors, and with academia and civil society, if any meaningful change is to be possible before we reach a global environmental tipping point. We need to find a way to persuade all actors to incorporate NBS as part of their core business risk management strategy and find ways to clearly articulate the return on investment to wider audiences. Governments must be targeted to support and underwrite actions by private and local institutions. The NBS community must start speaking the language of the priority audiences it needs to reach with realistic and practical actions that identified institutions must take [Andy Andrea, Alliance for Impact].

Thus, there is a need for the NBS community to develop tangible and easily communicated collaborative actions that bring together multiple sectors for the financing of NBS.

4.2.2.1 Public-private partnerships

Participants pointed out that NBS projects can be co-developed and co-financed as public-private partnerships (PPPs), which can include the public sector, financial institutions, and private enterprises. PPP harness both the public and the private sector to provide goods and services that are conventionally supplied by the public sector, while easing the stringent budgetary constraints placed on public expenditure. The most common form of PPP is the “Design-Build-Finance-Maintain-Operate” contract, for which the private partner is entrusted with the full life cycle of the infrastructure, from design to construction, operation and maintenance, including fundraising. Since most PPPs have been implemented in the field of transport, healthcare, education and renewable energy, their potential for NBS is generally underexplored. For the most part, PPPs are financed by the private sector with the guarantee of an investment return (the risks are shared with the public sector); however, the PPP model can make use of blended finance, which may also be an underexplored opportunity.

PPP examples were presented during the PBF, including coral reef insurance in Mexico aiming to finance maintenance of coral reefs and to provide assured financing to restore

reefs after storm damage (see Box 8). Some hope that the concept will be extended to coastal habitats (e.g. mangroves) and even forests.

Box 8: Coral reef insurance in the Yucatan peninsula of Mexico

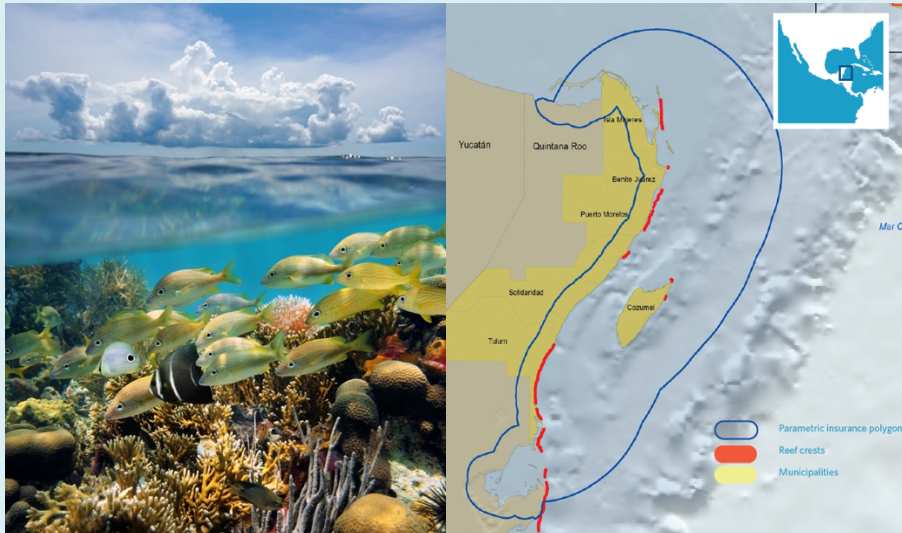


Figure 5: Coral reefs in Yucatan (left) and parametric insurance area in Quintana Roo (right) (Source: Photo 38114856 © Seadam, Dreamstime.com, TNC, 2021)

By providing shelter and feeding grounds for a plethora of marine species, coral reefs are among the most biodiverse habitats globally (Hughes et al., 2002) and they also fulfil a crucial coastal protection function by diffusing wave energy (Harris et al., 2018). Therefore, protecting and restoring coral reefs are key nature-based solutions for climate change adaptation and coastal protection.

The Mexican Caribbean coast, where tourism plays an important role in the local economy, is regularly hit by hurricanes. In 2005, two hurricanes caused estimated damages of US\$8 billion, particularly impacting hotels and other tourism-related activities (The Nature Conservancy, 2020). When it became clear that areas with intact reefs incurred much less damage, this catalysed the creation of the world’s first insurance for coral reefs. The insurance was bought in 2018 by the Trust for Coastal Zone Management, Social Development and Security, which was established by the Government Quintana Roo, a State in this area (Schelske et al., 2021). The trust brings together a wide range of stakeholders, including local municipalities, hotel associations, non-governmental organizations and local Secretariats for the Environment, Tourism, Finance and Planning, Public Safety, and Social Development (The Nature Conservancy, 2020). Thus, the purchase of insurance was a public-private endeavour.

The insurance is based on the principle that the costs associated with not repairing damages to coral reefs – that is, the damages created by storms when corals are not

healthy – largely exceed the cost of restoring a reef post-storm. When coral reefs are repaired after a storm, this increases their likelihood of recovery and continued fulfilment of their coastal protection role. The insurance in Quintana Roo is ‘parametric’, which means it is triggered if wind speeds within a certain area exceed a certain limit (in this case, 100 knots). The insurance was first triggered in 2020 with Hurricane Delta, leading to a USD 850,000 insurance payout to the Quintana Roo Government, earmarked to repair the coral reef. Although this concept has the potential to increase funding of NBS, it mainly addresses residual risk after a catastrophic event. The concept is hoped to be extended to other types of coral reef risks (e.g. coral bleaching), coastal habitats (e.g. mangroves) and even forests.

Other examples discussed at the PBF include the water stewardship project “Eau de Paris”, for which authorities in France aimed to improve water quality by reducing diffuse pollution from agriculture. Several PPPs were discussed, including public project procurement, water stewardship (e.g. private companies investing and commissioning third parties to implement measures and reduce risk), collective investment schemes (e.g. pooling resources from different beneficiaries) and environmental markets (e.g. dedicated markets, usually subject to oversight by a regulatory body). Water security strategies can translate into a pipeline of projects that are investable from a public and/or private perspective. In this context, a complete business case needs to be part of the strategy. The building blocks of NBS financing frameworks – including governance mode, funding, financing and procurement strategy – also play a critical role. Public-private partnerships can optimize the time and investment of each partner (see Box 9).

Box 9: The Upper Tana-Nairobi Water Fund



Figure 6: Tana River Watershed (Source: UTNWF Trust, 2021)

The Upper Tana basin in Kenya is home to 5.3 million people and areas of high biodiversity and agricultural importance. The basin supplies 95% of the water for the 9 million people living within the basin and the city of Nairobi and 50% of the country’s

hydropower. Yet, about 60% of Nairobi's city residents are considered water insecure. The conversion of upstream forests and wetlands to agricultural land has led to pollution and heavy sedimentation, reducing reservoir capacity, and increasing the cost of water treatment for downstream supply.

To address this issue, The Nature Conservancy created the Upper Tana-Nairobi Water Fund in 2015, which acquired official independent status as a non-government organization in 2021. Downstream, private companies (e.g. Coca-Cola, United Parcel Service and Caterpillar), utilities and local governments invest in water security through donations to the Fund, which proves less expensive than addressing poor water quality problems directly. Upstream, the funding is used to engage, train and equip local farmers with the resources needed to protect natural systems through agroforestry, reforestation, rainwater harvesting, slope terracing, buffer zone creation and other water and soil conservation activities that not only improve water quality and supply, but also provide economic benefits to farmers through increased crop yields.

Following its success, the Fund is further building partnerships with upstream local governments and community organizations to expand the use of NBS in the area, establishing a robust monitoring and evaluation plan to regularly demonstrate the Fund's impact and maintain the confidence and support received from investors.

Source: UTNWF Trust (2021)

4.2.3 Public financing

Estimates indicate that around 83% of NBS have been publicly funded (UNEP, 2022). Indeed, despite economic incentives for private investment, NBS are largely public goods with limited potential for the private sector to capture revenues. Indeed, it is costly and/or impossible to exclude anyone from their use (non-excludability) and the benefits of NBS do not decrease if only one person makes use of them (non-rivalrous). In the absence of private financing, public investment in NBS can typically be justified by their benefits to multiple sectors and beneficiaries. NBS can play a critical role in ensuring that the post-COVID 19 Recovery Fund (estimated at €1.8 trillion), as well as the implementation of the EU Recovery and Resilience Facility are green, healthy, just and equitable. The financing provided at the EU scale can support private investment across a wide spectrum of business models.

Public authorities finance NBS by commissioning private contractors to design and construct public infrastructure, which can be characterized by a long procurement process. Examples from the PHUSICOS project include public procurement for the construction of wooded barriers for landslide prevention in the Pyrenees (see Box 10) and the natural and receded barriers for flood mitigation in Gudbrandsdalen, Norway.

Box 10: Experimental sites in Artouste (France) and Erill-la-Vall (Spain)

At the Artouste site, the participatory process, combined with a progressive appropriation of NBS for protection against natural hazards, have led to the collaborative design of an experimental project at the Artouste site. The project is an open-air laboratory jointly set up by the municipality, the Polytechnic University of Madrid and a private company specializing in wooden construction. Different wooden structures are being tested to evaluate their resistance and effectiveness against rock falls. The innovation, in this case, is the establishment of the laboratory on the initiative of local authorities and technicians with the support of academia and science, while promoting the use of local timber species and stocks and supporting and raising awareness of the local economic context. Ultimately, the project has the potential to evolve as a reference in the Pyrenees, and to serve in the development of NBS for natural hazards.



Figure 7: Meeting with Municipal authorities to discuss NBS works in the Artouste site (Source: Didier Vergès, CTP-OPCC, 2022)

Another experimental project of the PHUSICOS project demonstrators is in the Spanish Pyrenees, in Erill-la-Vall. The project, for which construction began in May 2022, followed a thorough preparation process supported by 15 years of monitoring within the framework of a PhD programme and a relationship of trust between the scientist and the municipal authorities. Technical studies were completed and a prototype was tested prior to the project launch. On-site activities included the installation of terraces, which were built with local rocks and whole log gabions in the lower parts of the gully, along with revegetation to mitigate the risks of debris flows that have historically affected the town and peri-urban areas in the event of heavy rains. In addition to the broad direct benefits of these risk-reduction measures, the project also built on the historical memory and technical and local knowledge of the local population, students, villagers and municipal authorities. This process, easy access to data and a direct understanding of the outcome and effectiveness of the NBS have contributed to increased ownership and commitment from local residents and authorities.

This experience has sparked the interest of the municipal government to carry out a comprehensive study of all the gullies in the area for the preparation of a disaster risk management plan. This is a valuable step forward to generate knowledge and experience and thus facilitate the processes of replication and upscaling of NBS to address natural hazards in Pyrenean mountain areas.



Figure 8: View of the village of Erill and the gullies behind it (Source: Anders Solheim, NGI, 2022)

Typically, public investment in NBS yields benefits to multiple sectors and beneficiaries. One participant described a public investment in a nature-based infrastructure facility in Cyprus – a facility justified by the avoided damage costs thanks to its flood reduction services and other co-benefits, including enhancement of biodiversity, provision of habitat, soil erosion control and carbon sequestration:

We believe there can be a new financing model deployed on the local level that looks at avoided costs, and we can use these costs to implement NBS upstream and, of course, specific business models have to be worked on, depending on the local context and institutions. This includes differences in how the damages are covered when disaster happens, which minister is in charge, what role the region has, and so on [Juraj Jurik, Global Infrastructure Basel Foundation].

Equally, payments for ecosystem services are not confined to private markets, as described in earlier examples. Taxpayers can also pay for the private provision of these services (see Box 11).

Box 11: Payments for ecosystem services in the Serchio, Italy PHUSICOS demonstration site

In Italy's Serchio River Basin, the surface runoff of rainwater causes erosion with progressive loss of soil and passage of soil elements, manure and pesticides from agricultural land to Massaciuccoli Lake. Building on a successful stakeholder process, farmers in the basin have agreed to give up cropping on parts of their fields and to construct buffer strips along the small waterways. This will reduce erosion to their own fields and reduce contaminated runoff into the lake. Since the buffer strips will be populated with selected native plant species, it will also improve biodiversity in the basin. The farmers are paid for providing these ecosystem services – namely NBS creation and maintenance – by the public authorities (Consorzio di Bonifica) who also act as facilitators in the relationship between farmers and farmer associations.

Farmers receive payments to plant and maintain NBS and compensation for their harvest loss. Such payments for ecosystem services can be mainstreamed with tariff tables and other forms of compensation for farmers, foresters and others who create and maintain NBS. Moreover, the quantification of NBS contributions to the improvement of ecosystem services and an efficient environmental monitoring system (soil, water, ecosystems, etc.) are necessary to recognize the NBS ecosystem value. Scaling up NBS into Management Plans is considered a next step, followed by the introduction of a tariff system at national level.



Figure 9: Sedimentation basin after completion (Source: ADBS, 2023).

4.2.4 Challenges across financial models

Important themes have emerged from the PBF discussions on NBS financing, which differentiate three financing models: private, blended and public. The messages include the potential for PPP, payments for eco-system services, the importance and challenge of assessing NBS value to investors and society, and the potential for innovative financing instruments. Examples of cross-cutting themes across private and public financing models (and their blend) is shown in Table 3.

Table 3: Cross-cutting themes for each of three financing models discussed with PBF participants

Private financing model	Blended financing model	Public financing model
<i>Public Private Partnerships</i>		
PPPs can be co-designed, constructed, operated and/or maintained and financed by private sector agents. This can be enabled by the public sector by sharing risks (e.g. a wildlife park built and operated by a private company, with public authorities guaranteeing private loans).	The NBS is co-designed and constructed by a public-private consortium and co-financed (e.g. construction of green roofs on public housing with public subsidies).	A public agency finances the NBS, which is designed, constructed, operated and/or maintained by the private sector (e.g. farmers in the Serchio River Basin are paid to establish and maintain buffer strips).
<i>Payments for Ecosystem Services</i>		
The private investor prices NBS ecosystem services and collects revenues from the beneficiaries or users (e.g. a developer provides a green space and collects user fees).	The costs of an ecosystem service are shared by the private and public sectors (e.g. residents install green roofs subsidized or partly subsidized by the municipality).	The NBS that provides ecosystem services is fully funded by taxpayers (e.g. re-forestation of private and public land).
<i>Value assessment and dealing with uncertainty</i>		
A firm's expected return on an NBS investment can be assessed through traditional methods (e.g. risk assessment and market surveys). Uncertainties may be great, requiring hedging instruments such as insurance.	A blended finance arrangement can reduce business uncertainty by transferring some of the risk to the public sector (e.g. the uncertainty of the efficacy of an urban flood protection measure can be hedged with government guarantees).	Public agencies assess the economic, social, and ecological returns on NBS investment. Traditional measures, like cost-benefit analysis, can capture wider benefits although quantification is complicated (e.g. measurements of discount rates, and estimations of benefits to future generations).
<i>Innovative financing instruments: opportunity for the private and public sectors</i>		
Beyond the firm's own capital, equity, credit and user fees, green bonds are becoming more prevalent, even for the private sector. A major innovation may be tying the resilience investment with reduced insurance premiums (e.g. potential of downstream residents paying for an upstream NBS to reduce their flood risk and combining this with a reduction in insurance premiums).	Innovative financial instruments to de-risk projects include risk underwriting, provision of guarantees, and technical assistance	Typical financing includes tax revenues, bonds and user fees with innovative resilience and catastrophe bonds with reductions in insurance premiums that would finance the bond repayment.

4.2.5 De-risking NBS

Insurance and reinsurance are risk-management instruments that have the potential to protect and enable NBS. Insurance is traditionally seen as a mechanism to compensate and absorb the shocks and costs of the unexpected. This function can also be applied to absorbing the costs of replenishing nature after its destruction. Insurance can equally help to spread NBS risks including their construction (e.g. risks of delays and budget overruns) and performance (e.g. liability), making projects more attractive to both private and public investors.

The insurance sector also has a crucial role to play. They could play a role of capitalizing investments in NBS by implementing risk-based premiums that recognize the systemic resilience levels that NBS contribute to. They could require many more resilient standards when they are institutional investors, but they also could develop new insurance schemes [Monica Altamirano, Deltares and World Association of Public Private Partnership units and professionals].

Insurance applications in support of nature-positive initiatives include: (1) protecting businesses' natural assets, inputs and eco-system revenues (e.g. by insuring economically valuable forest wood in fire-susceptible areas); (2) protecting investors against NBS project damage and delays (e.g. Swiss Re provided cover for the construction of a large natural protection dike in the Netherlands); and (3) insuring governments against the costs of NBS restoration and post-disaster clean up (e.g. Swiss Re provided cover to municipalities in Mexico to repair hurricane damage to coral reefs).

Special emphasis was placed on the need to insure design- and construction-related risks, as well as the risks associated with liability over the performance of the solutions.

Engineering insurance coverage during the NBS construction process protects projects from delays and disruptions. Challenges can also arise due to the difficulties in assessing NBS robustness, a process in which infrastructure, materials and their properties are better understood. This is distinct in many ways to the assessment that is done for grey initiatives. Typically, probabilistic risk assessments rely on historical data, which is becoming less relevant given rapid changes in hazard, exposure and vulnerability due to climate change inter alia. There is little historical operating experience and data specific to NBS, however, this is slowly changing as more NBS knowledge and experience is gained. Companies are expected to increase their NBS operations and risk-taking as they gain experience and as insurance products become more available.

The potential of insurance to cover NBS performance was also emphasized. For example, if a municipality invests in wetlands and tree planting as an alternative to concrete levies, can it be held liable if private properties are flooded? Such concerns about NBS performance are common:

This, of course, is a concern of both public and private investors especially given the dearth of information on NBS performance [Amy Oen, Norwegian Geotechnical Institute].

Liability insurance products are problematic to design and, to date, few exist, given the difficulty of performing risk assessments for NBS. The lack of design standards that

might limit liability is also a concern. Only engineering contractors with extensive experience and good track records might be eligible for liability coverage.

Participants also stressed the potential role of governments as ‘insurers of last resort’, given the reluctance of insurers to cover ‘unknown’ risks and the reluctance of investors to undertake risky NBS. Government institutions could assume some responsibility either by offering reinsurance to primary insurers or assuming the role of primary insurer:

I think there could be a real possibility here that the government offers some kind of insurance to the insurers. There can be a level that they insure up to, and then the government comes in after that. This would give the security to municipalities and businesses to take on riskier projects [JoAnne Linnerooth-Bayer, IIASA].

State guarantees have indeed been implemented in the French system for example. Research results show that in some situations government participation in state guarantees or in private-state insurance solutions can help to avoid a collapse of insurance markets (Nguyen, 2013). However, state risk-sharing must not subsidise certain enterprises or sectors as it would lead to the false allocation of risk in society.

Community-based insurance alternatives are an interesting option. Modelled after the National Flood Insurance Program’s Community Rating System in the United States, community residents are given a discount on their insurance premiums if the community invests in flood protection. Communities would thus put pressure on their politicians and authorities to take collective action, which would then result in savings at the individual level.

Finally, at present, insurance companies do not usually invest directly in NBS projects but rather charge a premium for their services and spread out the payments. Here, participants believe that the direct involvement of businesses could be incentivized by a shift in mindset and the support of financial mechanisms recognizing the real value of nature. Insurers can play a positive role here. For instance, a potential extensively discussed in insurance policy circles, is for insurers to divest from nature-negative assets in their extensive investment portfolios (see section 4.1.2.3).

4.2.6 Summary

Several key points on financing models emerged in section 4.2., including co-financing options, barriers to private financing, de-risking and insuring NBS.

Co-financing options: For many NBS investments, private investors have difficulty capturing revenues that generate a sufficient return on their investment, which limits interest from traditional financial institutions. To address this, co-financing options can provide incentives to private investors, including subsidies and tax rebates for NBS investments. Participants pointed out that NBS projects can be co-developed and co-financed as public-private partnerships (PPPs) alternatively, which can include the public sector, financial institutions, and private enterprises. Another promising trend is the upscaling of innovative private and blended financing models such as collective investment schemes and stewardship schemes.

Barriers to private financing: Private firms are more likely to opt for NBS investment if the direct benefits, or revenues, to the enterprise outweigh the investment costs more than other options. Private individuals or entrepreneurs might then fully finance NBS, with their own capital or with credit from a private or public bank such as the European Bank for Reconstruction and Development (EBRD) or the European Investment Bank (EIB). As noted by participants, however, identifying ‘bankable’ projects presents a formidable challenge. Other barriers to private financing include a lack of information on NBS effectiveness, unfavourable regulations, lack of awareness on behalf of enterprises, and path dependency and difficulties in shifting norms and culture from traditional grey solutions. Lack of knowledge and uncertainty in the effectiveness of NBS are other formidable barriers for private investment in NBS infrastructure, which might be overcome by deploying innovative financial instruments to de-risk projects (e.g. private or public insurance and provision of public guarantees).

De-risking NBS: To de-risk NBS projects, innovative financial instruments can be deployed. In addition to insurance and government guarantees, another innovation is the so-called ‘resilience bond’, a variation on green bonds that seeks to raise capital specifically for climate resilient investments. More precisely, resilience bonds are a form of catastrophe bonds that link insurance premiums to resilience projects in order to monetize avoided losses through a rebate structure.

Insuring NBS: Insurance and reinsurance schemes applied to NBS could play a significant role in spreading the risks associated with their design, construction, and performance, covering, for example, risks of delays and budget overruns, as well as liability over their performance. Insurance can reduce the risks of implementing NBS, notably in high-risk cases, such as NBS for DRR and climate change adaptation, which traditionally employ grey solutions. Other risk-reduction alternatives include the participation of governments as insurers or reinsurers to absorb a portion of the risk, as well as the possibility of introducing community-based insurance schemes. However, to do so, clearer design standards and the accumulation of operational experience and data to support the effective development of risk assessments are required.

4.3 NBS private sector capacity-building

In this section, we describe the key themes linked to capacity-building innovation for NBS as they emerged during the PBF deliberations, namely: NBS expertise, awareness raising and education, and communities of practice.

4.3.1 NBS expertise

A formidable challenge for NBS implementation is related to expertise availability for NBS planning and construction with a noticeable knowledge divide between those designing NBS (e.g. landscape architects and other NBS experts or consultants), and those who carry out the implementation of solutions in the field. Micro-, small and medium enterprises are often responsible for NBS construction, however, many have reportedly encountered challenges ranging from a lack of NBS knowledge and basic

business and marketing skills, to a lack of practical experience in constructing NBS. As reported by one participant:

We are working in Greece and the problem is that construction companies have no experience with developing NBS. They may have the necessary infrastructure tools, but they do not have the skills or people who know how to design and plan such solutions [Juraj Jurik, Global Infrastructure Basel Foundation].

There is also a deficit in research and development for NBS. Many companies that engage in the NBS implementation process have technical or environmental backgrounds and are less likely to possess the required knowledge and tools to adequately conduct research and development of their products and/or services upon their deployment. Another major challenge to promoting the wider use of NBS is the creation of specialized companies (see Box 12).

Box 12: The private sector role in innovative restoration of biodiversity through “Hydroseeding” in Kaunertal valley (Austria)

In the Natura 2000 protected area of the Kaunertal valley, Austria, an innovative mixture of local and altitude-adapted seeds and microbiome was developed and applied as an NBS for improving slope stability in an Austrian high-mountain area. Seed mixtures for greening purposes have been used for years in mountain environments without taking into consideration their suitability for the respective ecosystem. The Kaunertal Valley saw the introduction of Lupines through these seed mixtures. Originating at lower altitudes, this neophyte became a pest in the sprayed areas and extended to altitudes above 2300 m, contributing significantly to a loss of biodiversity in the local natural ecosystem. Projects were introduced to reduce the abundance of the plants including the fencing of grazing cows in small areas to force them to consume this plant, however, they were not successful in the long run. Reports from Iceland illustrate the same mistake and document the ongoing struggle of communes to fight this invasive species that is repressing the native ecosystem.

A seed mixture was thus developed reflecting the local and altitude-adapted abundance of the plants. Currently one of the most biodiverse mixtures for altitudes above 1,700 m, it has been used at ski resorts in the Kaunertal region, financed partly by the PHUSICOS project and local stakeholders. The mixture is sprayed on slopes and eroded areas to enhance and restore biodiversity and slope stability. The greater the vegetation cover and the more biologically diverse an area is, the more it will translate into stability. The Kaunertal project is one of the first applications of such an approach targeting natural rather than agricultural vegetation. The erosion-reduction effect will be evaluated in the coming years.

The new seed mixture contains a potent variety of local seeds and is dispersed with organic glue and cellulose shortly before the first snowfall. Seeds need to rest in winter under the snow cover, so the glue and cellulose will give them a head start with the snow melt in May/June, allowing the tiny seeds to remain on the slope and germinate in the organic cellulose layer. Furthermore, and importantly, the mixture contains a

local microbiome supporting the growth of plant functionalities that will reduce erosion, such as more leaves and longer and denser roots.

The private sector has proven key for the implementation of this NBS. In fact, only a few private companies currently produce seed mixtures in Europe. Therefore, issues related to the availability of certain seeds, their cost and the expense of scaling up production exist. A major challenge to promoting the wider use of this NBS is, consequently, the creation of specialized companies.



Figure 10: Vegetation plots to test bacteria-assisted vegetation cover (left) and preparation of seed mixture (right) (Source: UNIVIE:2023).

This adds to the already known difficulties of accurately assessing NBS impacts and effectiveness. To address these challenges, a variety of ideas arose from the participants. Three of them are presented below.

4.3.2 Awareness raising and education

Participants agreed that an important and often discussed topic for NBS upscaling is raising awareness of NBS benefits and co-benefits, including related business opportunities (Anderson & Renaud, 2021; Solheim et al., 2021). Key stakeholders must be well informed about the multiple benefits of NBS in comparison with their grey counterparts. However, it is essential that both construction firms and nature-based enterprises – defined as for-profit enterprises that use nature as a central element of their product or service offering (McQuaid et al., 2021) – be equipped with the necessary tools before venturing into NBS implementation.

The salience of the knowledge barrier for private sector initiatives was illustrated, for example, by the river renaturation project in Geneva, Switzerland, which was made possible by a federal government initiative. More precisely, the Law on Water amended in 1997 alongside the provisioning of a fund and the competencies centralized in the Cantonal Renaturation Agency allowed for extended NBS implementation with more than 100 projects for most rivers in the Canton of Geneva. These projects provided guaranteed protection from major flood risk by 2023 but witnessed limited private sector engagement.

Education for private sector actors to better understand, identify and prioritize NBS implementation is also key. Promising approaches need to take into account the fact that private actors do not often have time to undertake long-term training activities:

Actually, [private sector actors] are very busy, they need “ready-to-use” information. Some of this should come from the private sector itself, but I think that quick online courses or webinars are the best way to reach out to them [Karen Sudmeier, University of Cologne, Germany].

Facilitating education and training can serve to enrich contractor skills, for example, to better identify feasible projects and practical solutions. Such training can improve competitiveness during bidding processes against larger companies that are not necessarily specialized in NBS but that have greater bidding experience. Training is equally decisive for companies providing solution maintenance.

I observed a lack of skills, especially to maintain NBS. Some companies are very focused and know how to do the renaturation projects. However, the guarantee of cost-effectiveness may come at a price, e.g. difficulties to guarantee long-term maintenance [Nathalie Nyssen, Firmenich].

Current projects, such as PHUSICOS demonstration sites and the Geneva River renaturation project in Switzerland, can be leveraged as catalysts to create and increase the visibility of successful NBS and inspire future actions. Pedagogical and educational activities conducted in the PHUSICOS project included documentaries, educational activities, the use of Legos and virtual reality (see Boxes 13 and 14).

Box 13: Pedagogical innovation in the Kaunertal-case, Austria, through documentaries, educational activities, and the use of Legos

At the PHUSICOS Kaunertal site, an interdisciplinary effort between geomorphologists and ecologists aims at demonstrating the stabilizing effect of vegetation and the growth-promoting effects of bacteria to enhance plant traits contributing to slope stability. The project focused on outreach, dissemination, and citizen science, especially the educational activities, whose multi-channel and multi-modal nature proved to be innovative and successful.

Educational activities generally targeted three groups: children, adolescents, and adults. Researchers used their knowledge for pedagogical innovation. Previous experiences in the use of Lego models at science festivals such as the ‘long night of science’ were highly successful with such ‘hands-on’ approaches to educating children. A Lego model was thus again developed here to simulate the surface change analyses of the Kaunertal glacier foreland. The model shows in an interactive, simplified, and visual way how a glacier forefield looks, how the mobile drones are used to fly over the area to analyse vegetation cover and other aspects, and to measure succession and erosion with multiple drone flights and model generations.



Figure 11: Creative outreach for the Kaunertal case with the use of Lego models (Source: UNIVIE, 2023).

Additionally, documentaries and movies were produced using platforms such as YouTube for their dissemination, many targeted adults in the general public. YouTube movies were produced professionally in parallel with the fieldwork. After uploading and disseminating their documentaries, the team was approached by journalists interested in their topics who wished to engage further. Journalists were helpful in formulating the methods, work and results in an understandable manner, which led to increased public interest, and ultimately to further engagements. The collaboration led to appearances on and engagements with Austrian TV (ORF, TV Tyrol) and international programmes (Arte). Numerous lessons were learned from working with journalists. First, it is not always easy to make technical terms understandable to non-experts. A competent journalist may ask researchers to break complex concepts down for the target audience. Second, science will need to be rephrased, which can result in misrepresentations of the concepts, at least as intended by the researcher. Many researchers thus fear misinterpretation and shy away from public interviews.

ORF: <https://tv.orf.at/program/orf3/landderber362.html>

YouTube: <https://www.youtube.com/watch?v=OinquHXN3WE>

Arte: In production (April 2023)



Figure 12: Application of seed mixture to the test vegetation plots (Source: UNIVIE, 2023).

Box 14: Virtual reality for educating stakeholders on the uses and benefits of Nature-Based Solutions (Pan-European)

A Virtual-Reality (VR) learning platform has been successfully employed as an innovative tool to demonstrate the value of NBS to politicians, key decisionmakers and the general public in a European and global context. The VR learning platform, PHUSICOS-VR, shows how different Nature-based Solutions (NBS) across Europe can help mitigate natural hazards and increase safety. Developed as part of Work Package 6 Learning Arena activities, the game showcases examples of NBS use for the mitigation of natural hazards such as avalanches, floods, agricultural runoff and rockfall within diverse landscapes across Europe by using a VR headset.

This technology proved to be highly communicative for NBS education as it provides immersive experiences to participants. Research on the use of VR in an educational context shows that complex concepts can be learned in a relatively short time frame, and that the retention of the learning experience is greater than in comparative learning methods. The VR platform aims to raise awareness and show that NBS can be a valid alternative to grey solutions in many instances, while expanding the use of NBS beyond the interventions introduced in PHUSICOS.

The VR game has a pan-European focus including different case studies such as the Gudbrandsdalen valley, one of the PHUSICOS demonstration sites, one of Norway's longest and most populated valleys with rich floodplains along the Gudbrandsdalslågen river. Flood events are increasing there with frequent heavy rains causing severe damage to communities and agricultural areas. NBS could help not only to mitigate flood risks but also to provide innumerable co-benefits. Other PHUSICOS study sites are recreated in virtual models showing the challenges and a suggested NBS solution in the platform: agricultural run-off in the Serchio River Basin, avalanches in the Capet Forest, Pyrenees and rock falls in St Elena, also in the Pyrenees.

The PHUSICOS-VR platform is open and freely available to any stakeholder with access to VR. In addition, a corresponding web-based platform is available to anyone not having such goggles available. This web option has the same graphics, narration and functions as the VR version, but without the goggles. The immersive experience is thus only available in 2D. Innlandet County Authority, as owners of the VR platform, aims to enable the addition of new cases and examples to the platform through potential cooperation with other European Union projects or organizations.

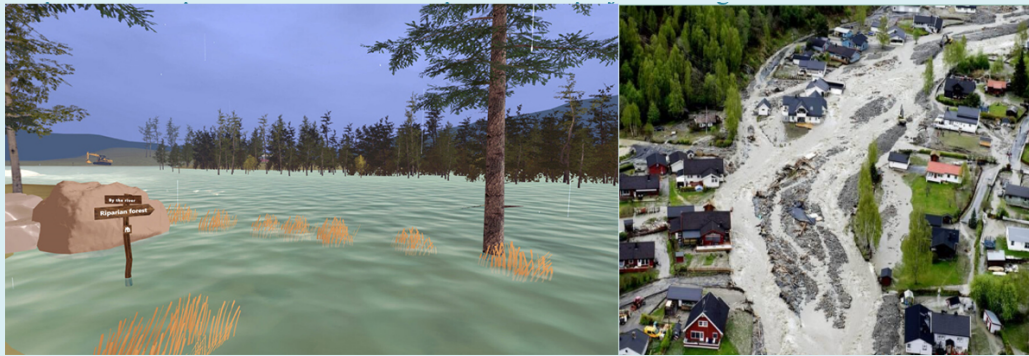


Figure 13: Virtual reality game illustration (left) (Source: PHUSICOS, 2018). The village Kvam and the river Veikleåa (right) (Source: NGI, 2022).

Another emerging theme was the need to change the attitudes of all involved parties, public authorities in particular, to encourage the consideration of NBS solutions from a more holistic perspective in which different sectors can work together to find common solutions. On many occasions, the skills and methods to implement NBS are available, but the willingness to leverage them and translate them into action is still lacking, together with confidence in the performance of NBS initiatives. Stakeholders’ readiness is therefore fundamental, together with the launching of pilot projects and experimentation.

4.3.3 Communities of practice

Collaboration was highlighted during the third PBF as a unique catalyst for increasing the capacity of contractors and boosting NBS success. Collaboration between NBS contractors and the public, academia, and civil society, together with the transferring of good practices is crucial for all actors to better understand NBS operation and use, stimulating discussion around them with a view towards their introduction or eventual scaling up. Collaboration can take place within or across regions and even across countries (see Box 15).

Box 15: Transnational upscaling: from Kaunertal, Austria to Argentina

The Kaunertal Valley in western Austria is exposed to erosion, resulting in rock falls, debris flows, and shallow landslides decreasing the mountain slope’s stability. Sediment dynamics have negative effects on important infrastructure such as roads, settlements, and the Gepatsch reservoir securing the stability of the electrical network in Germany.

In an interdisciplinary effort between geomorphologists and ecologists to address this issue, the stabilizing effect of vegetation and the growth-promoting effects of bacteria have been demonstrated in a controlled laboratory environment to enhance the vegetation elements that contribute most to slope stability, followed by the implementation of the method on real erosive sites in a ski resort to be evaluated in summer 2023. To allow further upscaling of the approach, a proposal for an additional

€1.5 million was submitted involving a local stakeholder and the municipality. This will allow the expansion of the NBS for local problem-solving to become a showcase for other regions and involve new project partners.

Independently of any potential success of the recent proposal, spillover effects can be identified already. For example, the ski resort in the neighbouring Pitztal valley has expressed its interest in implementing the NBS if the restoration of local natural ecosystems through Hydroseeding proves to be a success. Moreover, as the CEO of that ski resort is also in charge of a privately owned ski resort in Argentina, he is very interested in proposing the introduction of a similar innovative seed mix, following successful implementation in Austria.

From a commercial perspective, the Hydroseeding approach promises to be a cost-effective and easily implemented NBS for high mountain areas and considerably less expensive than grey structures or the use of a static wooden structure with a lifetime of approximately 15 years. To date, successful validation has only been carried out in a controlled laboratory environment, but if validated on a larger scale, stakeholders from the ski resort in the neighbouring Kaunertal valley, the Argentine ski resort and the Pyrenees would initiate proceedings for its implementation.



Figure 14: Applied seed mixture in the Kaunertal demonstration sites Source: UNIVIE, 2023.

However, cross-sectoral and cross-disciplinary collaboration are an essential organizational innovation that needs to be boosted according to workshop participants. Collaboration with other companies working with NBS is a promising strategy for inexperienced or small enterprises, as cooperation with larger, more experienced firms can help develop their skills for implementing NBS solutions, creating a multiplier effect.

I have seen that small companies who are growing and doing NBS are doing businesses with and changing minds in larger companies. I think they have capacities. In Brazil, some landscape architects and construction engineers get together and they are reaching out to larger construction companies to implement some projects. It is almost like a demonstration, but it is a business that is leading to more projects, more visibility and more business [Cecilia Polacow Herzog, University of Lisbon].

What they [nature-based enterprises] would see as an enabler is having connections with peers and learning from others and from best practices, but also

support measures such as capacity building and training [Esmee Kooijman, Trinity College Dublin].

Because of the multi-disciplinary and local character of most NBS, designing solutions together with local governments and communities, who are aware of local realities, can be essential, creating instances of polycentric governance as for the Isar river, Germany (see Box 16).

Box 16: Polycentric governance for the Isar river restoration (Germany)

The Isar River of Munich, Germany, which rises in the Austrian Alps, has often been described as a “lifeline” for Munich’s cultural heritage, sense of place, and urban recreation. From 2000–2011, an 8-km stretch of the Isar was restored through what is now referred to as the Isar Plan project. The primary aims of the Isar Plan were increased flood protection, ecological restoration and recreational use. As part of this restoration effort, several nature-based solutions were implemented along the urban stretch of the river, including the widening and restructuring of the riverbed and the creation of fish passes.

An unprecedented governance arrangement proved key to enabling the successful implementation of the Isar Plan, the Isar Plan Working Group, created as an informal working group in 1987 and institutionalized by the Parliament in 1995. This interdisciplinary Working Group marked a critical milestone in the Isar story, as it dispersed decision authority across multiple organizations and authorities that went beyond just flood protection. One of the aims of the group was to discuss and resolve conflicts before they could escalate.

An important characteristic of the Working Group’s institutional framework was its polycentricity (Zingraff-Hamed et al., 2019), which denotes a system in which decisions are taken at different jurisdictional levels and scales (e.g. national, regional, global), through sometimes formally independent decision centres (Ostrom, 1999). Indeed, as the Isar River in Munich falls under several overlapping jurisdictions and their legal mandates—mainly at the state (Bavaria) and city (Munich) scales—the need for cross-scale and cross-sectoral coordination and cooperation was evident and became embodied in the Isar Working Group. Although the Working Group was formally composed of experts representing both the City of Munich (through the city’s relevant Divisions) and the State of Bavaria (through the Munich Water Agency), stakeholders from various other fields and sectors (ecology, hydrology, and civil society) were regularly invited to discuss specific issues or sections of the plan.

The working group members collaborated to advocate a far broader vision for the Isar than a customary focus on grey infrastructure for flood protection. This collaboration broke down the silos of water and urban planning and was unprecedented for projects of this magnitude.



Figure 15: The Isar River before the Isar Plan implementation at the Brudermühl bridge (left) (2001) and after (right) (2004) (Source: Mahida, 2012).

Polycentric governance and participatory processes can not only facilitate NBS implementation and success by increasing the likelihood that priority needs are addressed, but also ensure their sustainability and assist in reducing perceived benefits (see also Martin et al., 2019, 2021; Malekpour et al., 2021). One concern is an unfair distribution of NBS benefits resulting from the lack of or limited social considerations during NBS planning and implementation. Such is the case of gentrification problems observed as result of urban greening projects, in which a rise in property prices causes an influx of affluent people into the area, displacing lower-income inhabitants (Toxopeus et al., 2020; Davies et al., 2021; NetworkNature, 2022).

Collaboration can also help to highlight synergies and influence the type of technical initiatives that are launched, providing greater cross-functionality. Harnessing the potential of collaboration, however, requires the development of a common language and objectives. Some existing processes can be adapted to support effective communication, such as the creation of river basin management committees, community-based forest management groups, holding regular municipal meetings (e.g. about green spaces in the municipality), and the creation of sectoral knowledge hubs and industry alliances or associations.

4.3.4 Project preparation facilities and co-benefit catalogues

Awareness generation and the establishment of collaboration across scales and sectors, were highlighted along with the creation of support facilities and platforms for NBS contractors. Initiatives like PPFs can be particularly beneficial, in particular PPFs help small companies as they often require additional assistance and tools to successfully apply for tenders and access funding. Also, the need for more available information on the benefits and co-benefits of NBS to support private and public sector investors was emphasised.

If you introduce other types of elements for risk assessments, for instance, biodiversity and other co-benefits that we have, perhaps this information [regarding uncertainty of NBS] will be different. Introducing other types of risk

assessments than pure economics could also be a benefit for NBS. Then perhaps the funding will also be different [Bjørn Kalsnes, Norwegian Geotechnical Institute].

Another suggested tool to facilitate private sector engagement is a user-friendly benefit and co-benefit catalogue for the private sector (Karen Sudmeier-Rieux). Success stories include the cases of the Nature-based Accelerator programme in the city of Glasgow, Scotland and the nature-based solutions exemplar programme in Poznan, Poland. In the latter example, the initiative includes the development of an entrepreneurship programme that integrates education for decisionmakers and training on best practices for nature-based enterprises and NBS contractors.

4.3.5 Summary

Key points about NBS private sector capacity building from section 4.3. include creation of assistance for the development of NBS expertise in the private sector, and capacity-building for NBS contractors.

Creation of facilities for the private sector: Some formidable challenges for NBS implementation are related to the lack of specialized companies and the low supply of expertise for the planning and construction, in other words a lack of practical experience in implementing NBS or in basic business and marketing skills. Also, there are few companies specialized in NBS maintenance.

The creation of an NBS Project Preparation Facility (PPF) at the local and/or national scale and a user-friendly benefit and co-benefit catalogue for the private sector are options to support private sector development. PPFs can help nature-based enterprises from the conception, design, or scoping phases through to project execution and closure by providing support in the formulation of feasibility studies, risk assessments, tender applications, etc. As a complementary approach, accelerator programmes could offer start-ups growth and learning opportunities through intensive funding and mentoring.

Capacity-building for NBS contractors: The development of easily accessible learning tools is one potential strategy for improving the skills and capabilities of NBS contractors (e.g. consultants, designers, constructors, and maintenance companies) working in the NBS implementation process. Backed by experience, training courses and seminars, including online versions, can benefit contractors by providing evidence-based information on the potential uses, limitations, and maintenance of NBS in a wide range of scenarios. Moreover, such tools can serve to disseminate existing or emerging guidelines promoting best practices more effectively and providing clear recommendations. Improving contractor competence may significantly reduce the probability of NBS failure, thus positively impacting public perceptions and increasing the likelihood of replication. Finally, training and awareness-raising on already available guidelines and standards (e.g. the IUCN Global Standard for NBS) is paramount, along with constant improvement of such tools.

5 Discussion

We have presented the main results of the PBF deliberations, which were aimed at achieving a better understanding of how to improve policy, finance and governance mechanisms to enable greater use of NBS. Based on these results, several proposed innovations could lead to greater success on NBS acceptance and implementation.

We have identified the main problems and challenges, recommendations, and suggested innovation examples during the deliberations.

Starting from these results, we identify four main recommendations to unlock the potential of NBS (see Figure 16):

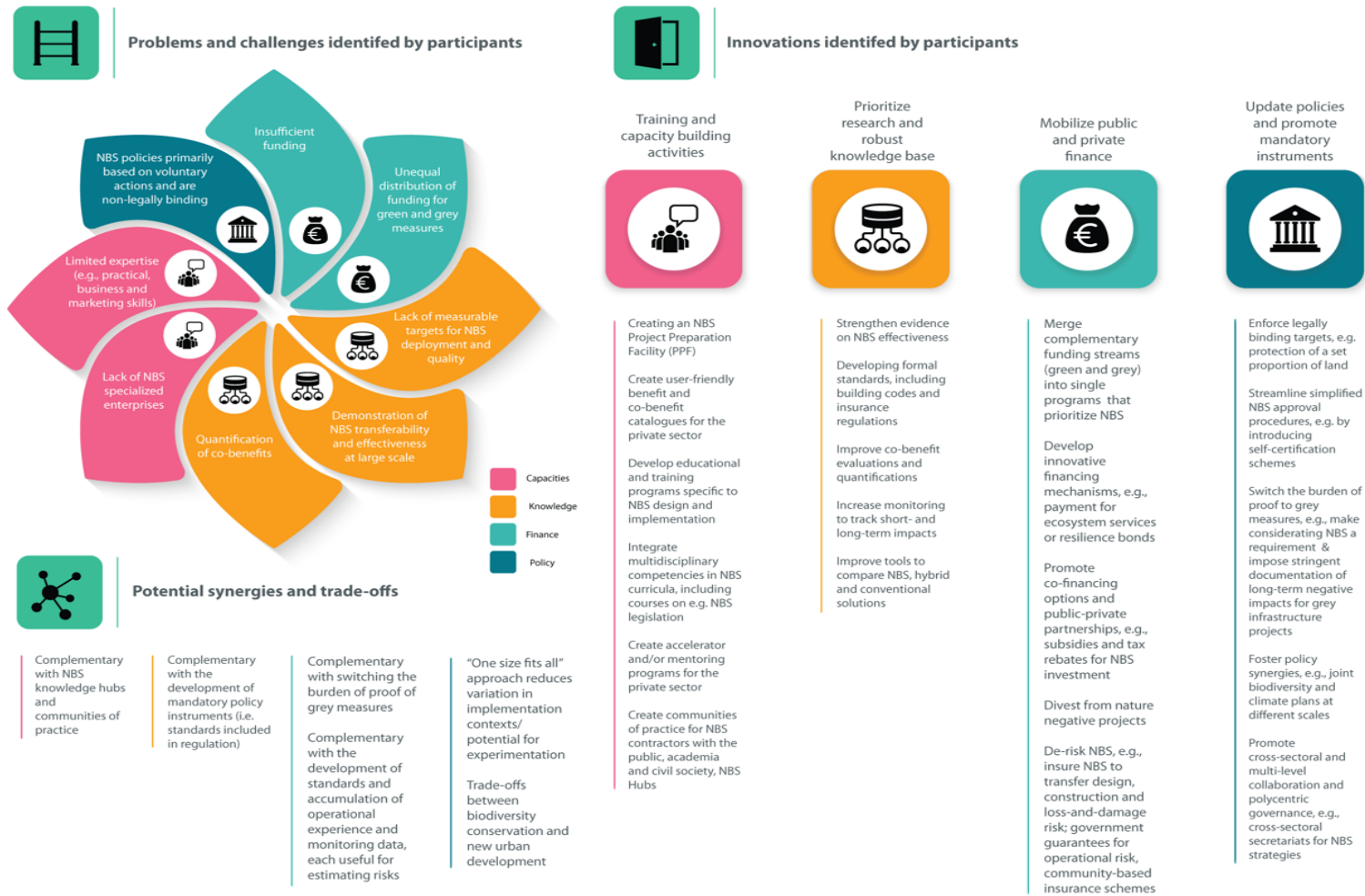
1. Update EU policies and promote mandatory policy instruments;
2. Mobilize public and private finance;
3. Prioritize research and a robust knowledge base;
4. Train the workforce and build capacities.

In the figure, we list suggested innovations for each of these recommendations. Importantly, there are synergies and trade-offs between these innovations. For example, the updates of policies and the promotion of mandatory policy instruments is interconnected to the development of formal standards, including building codes and insurance regulations. De-risking NBS, e.g. insuring NBS to transfer design, construction and loss-and-damage risk or considering government guarantees for operational risk is complementary with the development of standards and the accumulation of operational experience and monitoring data, which are useful for estimating risk. The creation of NBS project preparation facilities supporting nature-based enterprises can be harmonized to the development of NBS knowledge hubs and communities of practice. For these reasons, the suggested innovations should be considered complementary rather than stand alone.

In parallel, there are important trade-offs that cannot be overlooked. They may occur e.g. when biodiversity conservation efforts conflict with human wellbeing goals, such as promoting NBS and providing opportunities for urban development.

Another consideration is the time needed for the implementation of the suggested innovations. For example, several years may be required to collect a robust evidence base on NBS effectiveness or to quantify the co-benefits. The enforcement of legally binding targets or the creation of an NBS project preparation facility require political will and financial resources but can probably be achieved in the short(er) term. Following this reasoning, innovations can also be mapped across the different phases identified in research on innovation development, namely experimentation, stabilisation, diffusion/disruption and institutionalization/anchoring (Geels, 2019).

Figure 16: Challenges and suggested innovations



The methodological limitations of the results presented in this deliverable deserve consideration. Our methodology builds exclusively on a triangulation of different types of qualitative evidence collected through literature reviews, desktop research, interviews, surveys and workshops. The collection, and analysis of data related to stakeholder's perspectives raises questions concerning: (i) interviewee/participant selection and their representativeness of the NBS stakeholder landscape; (ii) choice of key themes and messages of the data analysis.

First, despite our best efforts to use a stakeholder database from which to randomly select participants with different backgrounds and expertise, no control was made of those who ultimately decided to attend. Certainly, there was an overrepresentation of participants who tended to have positive attitudes and/or be enthusiastic or highly supportive of NBS. Overall, we had fewer participants from the private than the public sector. However, this also reflects the present NBS implementation landscape since 83% of NBS are publicly funded (UNEP 2022).

Second, despite our efforts to co-identify relevant themes and collect participant's feedback about the key messages by triangulating different methods, we still used primarily our analytical lenses to draw out key findings from the deliberations. This is a shortcoming of qualitative research which ultimately relies on subjective judgements of those collecting and analysing the data (see Silverman, 2010 for a review).

Also, since participants were not asked to rank key messages/proposed innovations, the results provide an overview of the constellation of possible innovations, yet they do not provide any order of prioritization.

Future research could focus on better understanding which innovations have priority, for whom, at what scale (e.g. regional, national, or international scales), in which cultural/social/political/economic context and why. For example, a questionnaire could be administered to a representative sample of NBS and DRR experts and practitioners to choose which of the identified innovations have priority. This quantitative evidence can be the starting point to identify in more detail the pathways and steps needed to achieve the prioritized innovations. Also, it is critical to analyse in-depth which innovations have a broader consensus, which are contested, or easier or harder to address and why.

Finally, another research focus includes in-depth analysis of synergies, trade-offs, and interconnections between the suggested innovations and selected applications. We only marginally addressed these issues during the PBF deliberations and there is certainly a need to conduct more research on these aspects.

6 Conclusion

NBS can play a critical role in the protection, conservation, restoration, sustainable use and management of natural or modified terrestrial, freshwater, coastal and marine ecosystems, by addressing social, economic and environmental challenges effectively and adaptively and by providing benefits for human well-being, ecosystem services and resilience and biodiversity (UNEA5, 2022; for an overview of NBS definitions see White House, 2022; EC, 2015; Potschin et al., 2016).

Central to the concept of NBS is the emphasis on multifunctionality (Kabisch et al., 2016), i.e. the capacity to provide multiple and diverse benefits to people and nature in parallel (Albert et al., 2017), and a problem-centred and mission-oriented approach (Potschin et al., 2016). NBS target specific societal challenges, including climate change mitigation and adaptation, disaster risk, biodiversity loss, food and water security, human health, and socio-economic development (Cohen-Shacham et al., 2016). However, NBS have not reached their full potential.

For NBS implementation to become more widespread and effective, it is essential to transform governance structures and to create appropriate legal, institutional, political and financial conditions. While ambition at the international level is growing, policy development at national and regional levels, as well as NBS upscaling at local levels are often problematic. Current policies, regulations and path dependency from grey solutions often create substantial hurdles. Moreover, NBS policies are based primarily on voluntary actions and a non-binding mix of different instruments. Often, agencies and communities find funds for NBS insufficient and funding processes difficult to navigate or access. Also, the distribution of funding for green and grey measures is still very unequal. Likewise, private sector expertise to design and build NBS lags in many regions (White House 2022). Specialized NBS companies and business skills are rare. Finally, technical challenges, information deficits and uncertainties related to NBS effectiveness can also represent formidable obstacles, together with a lack of quantitative measurable targets for NBS deployment and quality. In order to address these and many other barriers to NBS implementation (for a systematic review of barriers see Martin et al., forthcoming; Solheim et al., 2021), we identify four recommendations, accompanied by suggested innovations:

1. Update EU policies and promote mandatory policy instruments, by considering the following:
 - Enforcing legally binding targets, e.g. reservation of a proportion of land for forest cover in Member States as in the proposed EU Nature Restoration Law;
 - Streamlining simplified NBS approval procedures, e.g. by introducing self-certification schemes;
 - Switching the burden of proof to grey measures, e.g. make consideration of NBS a requirement for infrastructure projects, make NBS compulsory elements of landscape planning; require stringent documentation of the long-term negative impacts of grey infrastructure;

- Fostering policy synergies by linking NBS policies to well-being and preventative healthcare policies or to green infrastructure, transport and mobility policies, e.g. joint biodiversity and climate plans at regional or national level; and
 - Promoting cross-sectoral and multi-level collaboration and polycentric governance arrangements, e.g. cross-sectoral secretariats for NBS strategies.
2. Mobilize public and private finance, by considering the following:
- Unlocking public and private funding for nature-positive activities with specific focus on funding for climate adaptation/disaster risk reduction;
 - Merging complementary funding streams (green and grey) into single programmes that prioritize NBS, such as disaster risk reduction plans or water management plans;
 - Developing innovative financing mechanisms, e.g. resilience bonds or payment for ecosystem services to address land availability problems;
 - Promoting co-financing options, e.g. subsidies and tax rebates for NBS investments;
 - Promoting partnerships between the public sector, financial institutions, and private enterprises and applying blended financing models, e.g. collective investment and stewardship schemes;
 - De-risking NBS, e.g. insure NBS to transfer risk of project design, construction and loss-and-damage from extreme weather; provide government guarantees for operational and liability risk; innovate with community-based insurance schemes;
 - Divesting from nature-negative projects and investing in nature-positive activities, e.g. expansion of EU taxonomy for sustainable finance.
3. Prioritize research and a robust knowledge base, by considering the following:
- Increasing monitoring to track short- and long-term impacts;
 - Strengthening evidence on NBS effectiveness;
 - Developing formal standards, including building codes and insurance regulations based on the evidence created;
 - Improving co-benefit evaluation and quantification, e.g. by better explaining NBS multi-functionality in climate adaptation and disaster risk reduction plans;
 - Improving tools to compare NBS, hybrid and conventional solutions.
4. Train the workforce and build capacities, by considering the following:
- Creating an NBS Project Preparation Facility (PPF) at the local and/or national level by providing support to nature-based enterprises, e.g. in the formulation of feasibility studies, risk assessments and tender applications;
 - Creating user-friendly benefit and co-benefit catalogues for the private sector;
 - Developing new educational and training programmes specific to NBS design and implementation, including on available guidelines and standards, e.g. the IUCN Global Standard for NBS;
 - Using innovative learning tools, e.g. virtual-reality learning platforms;

- Integrating multidisciplinary competencies in NBS curricula, including courses on NBS legislation;
- Creating accelerator programmes/mentoring to offer start-ups growth and learning opportunities through intensive funding and mentoring for a brief period of time;
- Creating communities of practice for NBS contractors with the public, academia and civil society through NBS Hubs.

We hope that these suggested innovations will contribute to unlock the potential of NBS and to prioritize them as key options in fighting climate change, biodiversity loss and reducing disaster risk.

Acknowledgements

The work described in this deliverable (5.3) was supported by the European Community's Seventh Framework Programme through the grant to the PHUSICOS Project (<https://phusicos.eu/>) (EU H2020 research and innovation programme grant agreement No. 776681). The deliverable reflects the authors' views and not those of the European Community. Neither the European Community nor any member of the PHUSICOS Consortium is liable for any use of the information in this report. We wish to thank all the colleagues, including all PHUSICOS partners, and persons who provided us with professional advice and collaboration for setting up the PBF. And we would like to express our gratitude to the 74 participants and presenters who dedicated their time to the interviews, surveys, workshops and all the activities linked to the PBF.

We also wish to thank the PHUSICOS project partners and members of the advisory board – especially Anders Solheim and Mark Pelling, reviewers for this deliverable – for their quality control and their support in improving this work. Last but not least, we are grateful to Julie de Rouville who edited the final version of this deliverable.

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APPENDICES

A1 1st Policy Business Forum Material



POLICY BUSINESS FORUM



Governance innovation for
nature-based solutions

24th of March 2020

University of
Geneva



Contact:
anna.scolobig@unige.ch

First workshop

Governance innovation for nature-based solutions: promises and challenges

Rationale and output of the workshop

There is growing recognition that nature-based solutions (NBS) can help provide viable and cost-effective solutions to a broad range of societal challenges. Among others, NBS can contribute to reducing natural risks and establishing climate resilient societies. As such, they are essential for the overall global effort to achieve the goals of the Paris Agreement on climate change. However, to realize their full potential, NBS must be mainstreamed into local, national and international governance regimes, including regulatory and financial procedures as well as into risk management, land use and spatial planning strategies.

The ambition of this workshop is to better understand the current state of NBS policies with specific focus on disaster risk reduction (DRR) and, more importantly, to identify the policy reforms necessary to drive NBS transformative action. What public policies need to be in place to effectively support NBS in the DRR sector? By addressing this question, we aim at characterizing options for NBS policy transition pathways.

Other expected outputs include:

- Summary of the key results to be shared with all participants for comments
- Contributing to the academic and public debate
- Getting the message out to policy-makers and the general public
- Agreeing on next steps

This event is one of the three workshops organised within the framework of the EU-funded project [PHUSICOS](#). The project will demonstrate how NBS can provide robust, sustainable and cost-effective measures for reducing the risk of extreme weather events in rural mountain landscapes. The PHUSICOS first report and policy brief on governance innovation (Work Package 5) are available [here](#).

Preparing for the workshop

In preparation for the workshop, we would like to ask you to send us three short written responses. These will guide the workshop discussions and ensure we get the most out of the day in Geneva.

1. Your personal background: What is your main interest in the workshop's topic? What motivated your engagement with NBS?
2. Main issues today: Please outline what you think is the single most critical challenge or issue related to NBS policies for DRR and their transition pathways. This might be something you think needs to be addressed, or something specific that has been overlooked in academia or practice for mainstreaming NBS into DRR policy. Where should the collective effort of practitioners and academics be directed in the future?
3. What are your expectations for the Policy Business Forum?

Please send you short text to Anna Scolobig (Anna.Scolobig@unige.ch) at the latest by **18th of March**. We will collect and structure the participants' input for the discussions.

Agenda

- 08:45-09:00** *Welcome to the virtual environment/videoconference setting*
NBS Policy Business Forum and participant introduction
- 09:00-09:15** Anna Scolobig and JoAnne Linnerooth-Bayer, University of Geneva and International Institute for Applied Systems Analysis
- 09:15-09:30** *The 2020 NBS Agenda*
Elise Buckle, Strategic Advisor to the United Nations and Director of Climate & Sustainability
15 min presentation
- 09:30-09:55** *NBS: Gaps and Opportunities in Policy and Science*
Karen Sudmeier-Rieux, United Nations Environment Programme
15 min presentation, 10 min discussion
- 09:55-10:20** *NBS policy mixes at the EU and Member States level: opportunities for the DRR sector*
Elisa Calliari, University College London
15 min presentation, 10 min discussion
- 10:20-10:30 Break
- 10:30-11:30** *Thematic session 1*
International NBS policies and instruments
Thematic session 2
- 11:30-12:20** National NBS policies and instruments
- 12:20-12:30** *Concluding remarks and information about the next PBF workshop*

Presentation Abstracts

The 2020 Action Agenda for climate, people and nature

Elise Buckle, Strategic Advisor to the United Nations and Director of Climate & Sustainability

2020 is a critical year for mainstreaming and investing in nature and people through a systemic approach that cuts across all the SDGs. This presentation will provide an overview of the 2020 agenda for climate, people and nature. The focus will be also on initiatives such as the New Deal for People and Nature, the Planetary Emergency, the NBS for climate manifesto, NatureNow campaign and other commitments to create a community of champions, and more in general, on the role of nature for disaster risk reduction and climate adaptation in the 2020 agenda for climate, people and nature.

Nature-based Solutions: gaps and opportunities in policy and science

Karen Sudmeier-Rieux, United Nations Environment Programme

Nature-based Solutions (NbS) is an umbrella term that spans several international framework agreements and scientific fields. This presentation will give a brief overview of international policies and programmes which cover various aspects of NbS, to identify opportunities for up-scaling NbS among international agencies and Member States. We identify a few EU policies and programmes of specific interest. Secondly, we give an overview of an on-going review of the peer-reviewed literature on a NbS subset: Ecosystem-based disaster risk reduction, which covered over 500 articles since 2000. The literature review provides conclusions about the robustness of scientific data on role of ecosystems in attenuating hazard impacts and gaps in our understanding of this field. The presentation concludes with a few recommendations and opportunities for bridging science and policy in promoting NbS.

NBS policy mixes at the EU and Member States level: opportunities for the DRR sector

Elisa Calliari, University College London

Nature-based solutions (NBS) are given centre stage at the EU level as a way to respond to societal challenges through innovative actions inspired or supported by nature. The European Commission expects that NBS can facilitate a transition towards a more resource efficient and competitive economy, foster economic growth and create new jobs, also in the DRR sector. Current policy mixes at the EU and Member State level provide a starting point for supporting this potential. In this presentation, we review policies and practices around NBS in selected Member States, with a focus on DRR and climate change adaptation. We conclude by discussing opportunities for financing NBS at the national level.

World café Thematic Sessions

Thematic session 1: International NBS policies and instruments

Background: Until only a few years ago, NBS were absent from political or public agendas. This is rapidly changing at all scales, and particularly at international fora, e.g. they have emerged on the COP 25 and (expected) COP 26 negotiations. At least 66% of the Paris Agreement signatories include NBS in some form to help achieve their climate change mitigation and/or adaptation goals. Thus, ambition at the national and international level is growing, as well as NBS implementation. NBS include multiple actions, ranging from tree planting, changing food production, reducing waste and taking actions on oceans. In this complex landscape, NBS for DRR purposes are not always at the heart of the climate debate nor of the NBS debate. Why not? How can we address the technical, financial and social barriers and push the NBS for DRR agenda forward?

Other core questions: How can NBS be mainstreamed into European DRR policy agendas? Will the EU Green Deal result in changing NBS policy? Are new directives and frameworks needed at the European level? If so, which ones (e.g. can the CAP include incentives for farmers to adopt NBS-targeted DRR)?

Thematic session 2: National NBS policies and instruments

Background: Successful NBS implementation depends critically on the legal, institutional, social, political, and financial conditions enabling the NBS policy process. Yet, these conditions vary depending on many different factors. Here we focus on how EU countries have implemented or are planning to implement NBS policy instruments (e.g. NBS standards, subsidies, regulations requiring NBS, legislation, but also institutional policy like setting up cross-department mandates). Are there cross-country differences in the NBS policies and instruments (for DRR) in Europe?

Other core questions: What are the main barriers to implement new national policies? Are some countries more advanced than others? Why so? Can NBS effectiveness be measured? How? Do we need new NBS national regulations? If so, on what (e.g. Is landslide mitigation in need of legislation about effects of roots systems, including quantification)?

Confirmed participants

	Name	Organisation	E-mail
1.	Andy Andrea	Alliance for Impact	andy.andrea@alliance4impact.com
2.	Chloe Baruffa	University of Geneva	chloe.baruffa@unige.ch
3.	Jörg Balsiger	University of Geneva	joerg.balsiger@unige.ch
4.	Mario Boccucci	UN-REDD Programme Secretariat	mario.boccucci@un.org
5.	Elise Buckle	Strategic Advisor to the United Nations and Director of Climate & Sustainability	ebuckle@climate-sustainability.org
6.	Elisa Calliari	University College London	e.calliari@ucl.ac.uk
7.	Louise Gallagher	University of Geneva	louise.gallagher@unige.ch
8.	Andrea Goltara	“Make Room for Rivers” centre, CIRF	a.goltara@cirf.org
9.	Juraj Jurik	Global Infrastructure Basel Foundation	juraj.jurik@gib-foundation.org
10.	JoAnne Linnerooth-Bayer	International Institute for Applied Systems Analysis	bayer@iiasa.ac.at
11.	Sandro Loi	University of Geneva	
12.	Juliette Martin	International Institute for Applied Systems Analysis	martinj@iiasa.ac.at
13.	Erik Mink	Consultant, Advisor European Dredging Association	erik@bilbo-ms.be
14.	Luca Pucci	Environmental NGO	l.pucci@legambiente.campania.it
15.	Anna Scolobig	University of Geneva	anna.scolobig@unige.ch
16.	Elisabeth Sibaud	Grand Lyon	esibaud@grandlyon.com
17.	Maurane Valdelfener	Grand Lyon	mavaldefener@grandlyon.com
18.	Karen Sudmeier	United Nations Environment Programme	karen.sudmeier@un.org
19.	Sylvia Wicander	United Nations Environment Programme World Conservation Monitoring Centre	sylvia.wicander@unep-wcmc.org
20.	Eva Zabey	Business for Nature	eva.zabey@businessfornature.org
21.	Julia Bethe	Business for Nature	julia.bethe@businessfornature.org
22.	Andrea Staccione	CMCC Venezia	andrea.staccione@cmcc.it

Organising team

Jörg Balsiger, Sandrine Billeau and Anna Scolobig

Environmental Governance and Territorial Development Institute

University of Geneva

Boulevard Carl-Vogt 66, CH-1205 Geneva, Switzerland | www.unige.ch/gedt/

JoAnne Linnerooth-Bayer and Juliette Martin
Risk and Resilience Program (RISK)
International Institute for Applied Systems Analysis
Schlossplatz 1, A-2361 Laxenburg, Austria | www.iiasa.ac.at

Contact:

Ann Scolobig

Anna.Scolobig@unige.ch

Mobile phone: +41 78 911 46 66

A2 2nd Policy Business Forum Material

POLICY BUSINESS FORUM

The role of public and private sectors in
mainstreaming nature-based solutions



19th of April 2021
9 AM - 12 PM

Save the date!

Contact:
anna.scolobig@unige.ch



The role of public and private sectors in mainstreaming Nature Based Solutions

Rationale and expected output of the workshop

At least 66% of the Paris Agreement signatories include nature-based solutions (NBS) to help achieve their climate change mitigation and/or adaptation goals. There is thus a growing recognition that NBS - here defined as solutions inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience (European Commission 2020) - can help provide viable solutions to a broad range of societal challenges. Among others, NBS can contribute to reducing natural hazards and establishing climate resilient societies. However, to realize their full potential, NBS must be mainstreamed into local, national, and international governance regimes, including regulatory and financial procedures, as well as into risk management, land use, and spatial planning strategies.

The ambition of this workshop is to better understand what role the public and private sectors can play in the design, planning and implementation of NBS with specific focus on disaster risk reduction (DRR). What public funding or incentives need to be in place to effectively support NBS in the DRR sector? What needs to change? How can we tap into 'macro' finance opportunities for NBS? What are the opportunities for conditionalities and offsets in promoting NBS? How can private investment be further incentivized? What role can NBS play to make the post-COVID 19 recovery and the implementation of the EU Recovery and Resilience Facility green, healthy, just and equitable? By addressing these questions, we aim at characterizing options for NBS policy and financing transition pathways.

The anticipated workshop outcomes include:

- Contributing to the academic and public debate with a publication of key results
- Getting the message out to policymakers and the general public
- Agreeing on further steps

This event is the second of three workshops organised within the framework of the EU-funded project [PHUSICOS](#). The project will demonstrate how NBS can provide robust, sustainable and cost-effective measures for reducing the risk of extreme weather events in rural mountain landscapes. The PHUSICOS first report, policy brief and synthesis of the first workshop on governance innovation (Work Package 5) are available [here](#).

Agenda

- 08:45-09:00** *Welcome to the virtual environment/videoconference setting*
- 09:00-09:15** *Welcome and NBS Policy Business Forum presentation*
Anna Scolobig (University of Geneva), Joanne Linnerooth-Bayer and Juliette Martin (International Institute for Applied Systems Analysis)
- 09:15-09:30** *Participant introduction*
- 09:30-09:40** *The potential of Public-Private cooperation for mainstreaming NBS and/or for NBS implementation at scale*
Monica A. Altamirano, Deltares and World Association of PPP units and professionals
- 09:40-09:50** *NBS in the European Bank for Reconstruction and Development Green Economy Transition (GET) strategy*
Sarah Duff, European Bank for Reconstruction and Development
- 09:50-10:30** Private sector business case
Thematic session 1
- 10:30-10:45 Break
- 10:45-10:55** *Enabling NBS financing to create climate resilient communities*
Juraj Jurik, Global Infrastructure Basel Foundation
- 10:55-11:05** *Payments for ecosystem services for NBS: an Italian case*
Nicola Del Seppia, Northern Apennines Hydrographic District Authority
- 11:05-11:45** Public sector mainstreaming
Thematic session 2
- 11:45-12:00** *Concluding remarks and information about the next PBF workshop*

Presentation Abstracts

The potential of Public-Private cooperation for mainstreaming NBS and/or for NBS implementation at scale

Monica A. Altamirano, Deltares and World Association of PPP units and professionals

This presentation provides an overview of the different Public-Private implementation and financing arrangements that have been successful in enabling implementation of NBS at scale.

This includes an alternative approach to project origination and investment planning (public and private) aimed at closing the implementation gap of hybrid (green-gray) NBS strategies by tackling important barriers for public and private sector investments in green infrastructure. The example of water security strategies will be presented. These strategies translate into a pipeline of projects that are investable from a public and/or private perspective. In this context, a complete business case per deal that makes part of the strategy is essential. Therefore, in this presentation a number of steps will be presented that are necessary to advance the business case of hybrid (green-gray) infrastructure projects and/or project

clusters that go beyond the strategic and economic one, into the commercial, financial and management business case.

NBS in the European Bank for Reconstruction and Development Green Economy Transition (GET) strategy

Sarah Duff, European Bank for Reconstruction and Development

Enabling NBS Financing to create climate resilient communities

Juraj Jurik, Global Infrastructure Basel Foundation

The objective of this presentation is to explore the financial and community engagement enablers that could pave the way to NBS adoption and mainstreaming. Specific attention will be dedicated to the presentation of a project that seeks to scale up public sector NBS projects for freshwater flood risk management across the Mediterranean region and beyond. The project will develop generalized guidelines for public sector stakeholders to assess, plan, and implement freshwater NBS. It will also test these guidelines with municipalities in Cyprus and Greece which have expressed interest in receiving support for planning NBS projects. For this, the project team will follow the guidelines for each municipality/region in order to assess feasibility for NBS projects and to develop a pipeline of projects for the municipalities/regions to invest in and implement, as well as a plan for financing them.

Payments for ecosystem services for NBS: an Italian case

Nicola Del Seppia, Northern Apennines Hydrographic District Authority

Because of the multiple environmental challenges faced by public authorities and by our societies more in general, it is critical to begin a governance review process leading to the recognition of the ecosystem value of NBS. In parallel it is necessary to identify methods, as well as scientific and economic systems of evaluation that allow to determine the payments of these functions / services (payments for ecosystem services). The aim of this presentation is to illustrate a process of nature-based solutions recognition as ecosystem services subject to payment in an Italian case study.

Thematic sessions: key questions

Private sector business case: How do private sector organisations define priorities for NBS action? What barriers do they encounter? Which of the many innovative market instruments hold promises for NBS scaling? How can public banks provide more funding for NBS?

Public sector mainstreaming: What are the priorities for mainstreaming NBS financing? How can public authorities foster synergies, not only between policy sectors but also between the public and private sector? Are there policies in place that hinder NBS financing? How can we get significantly increasing funding for the public sector NBS agenda (e.g. COVID-19 recovery fund)?

Participants

	Name	Organisation	E-mail
1.	Lucy Almond	Nature4Climate	lucy.almond@TNC.ORG
2.	Monica A. Altamirano	Deltares and World Association of PPP units and professionals	monica.altamirano@deltares.nl
3.	Idoia Arauzo	Communauté de Travail des Pyrénées	i.arauzo@ctp.org
4.	Elise Buckle	Strategic Advisor to the United Nations and Director of Climate & Sustainability	ebuckle@climate-sustainability.org
5.	Elisa Calliari	University College London	e.calliari@ucl.ac.uk
6.	Sergio Castellari	European Environment Agency, INGV	sergio.castellari@ingv.it sergio.castellari@eea.europa.eu
7.	Davies Craig	European Bank for Reconstruction and Development	daviesc@ebrd.com
8.	Nicola Del Seppia	Northern Apennines Hydrographic District Authority	ndelseppia@gmail.com
9.	David Dodd	World Association of PPP units and professionals	ddodd@wappp.org
10.	Sarah Duff	European Bank for Reconstruction and Development	duffs@ebrd.com
11.	Eva García	Communauté de Travail des Pyrénées	e.garcia@ctp.org
12.	Juraj Jurik	Global Infrastructure Basel Foundation	juraj.jurik@gib-foundation.org
13.	Bjorn Kalsnes	Norwegian Geotechnical Institute	bjorn.kalsnes@ngi.no
14.	JoAnne Linnerooth-Bayer	International Institute for Applied Systems Analysis	bayer@iiasa.ac.at
15.	Carla Lostrangio	Euromontana – European Association of Mountain Areas	carla.lostrangio@euromontana.org
16.	Gerd Lupp	Technical University of Munich	gerd.lupp@tum.de
17.	Juliette Martin	International Institute for Applied Systems Analysis	martinj@iiasa.ac.at
18.	Sharon Mcauslan	United Nations REDD	sharon.mcauslan@un-redd.org
19.	Nathalie Nyssen	CAS University of Geneva	nathalie_nyssen@yahoo.com
20.	Amy Oen	Norwegian Geotechnical Institute	amy.oen@ngi.no
21.	Luca Pucci	Environmental NGO	l.pucci@legambiente.campania.it
22.	Anna Scolobig	University of Geneva	anna.scolobig@unige.ch
23.	Karen Sudmeier	United Nations Environment Programme	karen.sudmeier@un.org
24.	Andrea Staccione	CMCC Venezia	andrea.staccione@cmcc.it

Organising team

Anna Scolobig and Jörg Balsiger

Environmental Governance and Territorial Development Institute

University of Geneva

Boulevard Carl-Vogt 66, CH-1205 Geneva, Switzerland | www.unige.ch/gedt/

JoAnne Linnerooth-Bayer and Juliette Martin

Equity and Justice Group (EQU)

International Institute for Applied Systems Analysis

Schlossplatz 1, A-2361 Laxenburg, Austria | www.iiasa.ac.at

Contact:

Anna.Scolobig@unige.ch Mobile phone: +41 78 911 46 66

A3 3rd Policy Business Forum Material



Third workshop

NBS private sector upscaling and capacity building

Rationale and expected output of the workshop

There is a growing recognition that NBS - here defined as solutions inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience (European Commission 2020) - can help provide viable solutions to a broad range of societal challenges linked to climate, biodiversity and health issues. Among others, NBS can contribute to reducing natural hazards and to accelerate the transformation to climate resilient societies. However, to realize their full potential, NBS must be mainstreamed into local, national, and international governance regimes, including regulatory and financial procedures, as well as into risk management, land use, and spatial planning strategies. For this to happen a necessary pre-requisite is the availability of expertise and knowledge to design, plan and implement NBS. This is often reported as one of the main barriers to NBS implementation.

The ambition of this workshop is to better understand how to fill this gap by addressing questions such as: What is the potential of firms specializing in NBS across Europe? What barriers and opportunities do conventional construction firms see in expanding their expertise? What NBS capacities need to be built? What are the priorities? How can public authorities foster synergies between different types of expertise? How do contractors define gaps for NBS projects preparation? What type of facility could support them? Are there policies in place that hinder or support NBS private sector upscaling?

By addressing these questions, we aim at contributing to the overall goal of the Policy Business Forum, consisting in identifying options for NBS policy and financing transition pathways.

The anticipated workshop outcomes include:

- Contributing to the academic and public debate with a publication of key results
- Getting the message out to policymakers and the general public

This event is the third workshop of the NBS Policy Business Forum (PBF) organised within the framework of the EU-funded project PHUSICOS. The project will demonstrate how NBS can provide robust, sustainable and cost-effective measures for reducing the risk of extreme weather events in rural mountain landscapes. The PHUSICOS deliverables, policy briefs and synthesis of the first and second workshops of the PBF are available [here](#).

Agenda

- 08:45-09:00** *Welcome to the virtual environment/videoconference setting*
- 09:00-09:15** *Welcome and NBS Policy Business Forum presentation*
Anna Scolobig, University of Geneva, Joanne Linnerooth-Bayer and Juliette Martin, International Institute for Applied Systems Analysis, Victoria Blessing, Network Nature
- 09:15-09:30** *NBS enterprises: success factors, enablers and barriers*
Esmee Kooijman, Trinity College Dublin, Ireland
- 09:30-09:45** *NBS capacity building - How to ensure high-quality NbS*
Dorsa Sheikholeslami, Nature-based Solutions Programme Officer, International Union for the Conservation of Nature (IUCN), Gland Switzerland
- 09:45-10:30** Developing capacities, project preparation and expert identification facilities
Thematic session 1
- 10:30-10:45 Break
- 10:45-10:55** *Case study: The experience of Geneva river renaturation projects*
Nathalie Nyssen, Firmenich, Geneva, Switzerland
- 10:55-11:05** *Case study: NBS as a landscape and public space strategy*
Annelies De Nijs, Agence Ter, Paris, France
- 11:05-11:15** *The role of insurance to protect natural assets and enable more nature-based solutions*
Elaine O'Brien, Swiss Re, Zurich, Switzerland
- 11:15-11:45** De-risking NBS
Thematic session 2
- 11:45-12:00** *Concluding remarks*

Abstracts

Nature-based Enterprises: Definition, Barriers and Enablers

Esmee Kooijman, Researcher at Trinity College Dublin, Ireland

Over the last years, the demand for nature-based solutions has increased. However, private sector supply of such solutions is still lacking behind. This presentation provides an overview of 'nature-based enterprises', which are driven by a clear mission to work with and for nature to address climate change and biodiversity challenges. These type of enterprises are active across many different economic sectors, from smart technologies to ecosystem restoration. In addition, the presentation will discuss barriers for the start-up and growth of nature-based enterprises, and will highlight recommendations and tools to overcome these.

NbS capacity building – How to ensure high-quality NbS

Dorsa Sheikholeslami, Nature-based Solutions Programme Officer, IUCN

Since the global recognition of Nature-based Solutions (NbS) with the adoption of the multilaterally agreed definition at the Fifth Session of the United Nations Environment Assembly (UNEA-5), now is the time to boost their implementation at scale to the benefit of nature and people. This presentation will provide an overview of IUCN work on mainstreaming and uptake of NbS, in particular, to strengthen the private sector engagement in sustainable development and to support them in achieving their climate and biodiversity targets. This presentation will also highlight the importance of international cooperation and collaboration, showcasing outcomes of EU-funded projects such as NetworkNature and CLEARINGHOUSE.

Case study: The experience of Geneva River renaturation projects

Nathalie Nyssen, Firmenich, Geneva, Switzerland

The case study focuses on river renaturation program in Geneva, a precursor in the field. The Law on Water amended in 1997 alongside the provisioning of a fund and the competencies centralized in the Cantonal Renaturation Agency has allowed to have extended implementation with more than 100 projects for most rivers in the Canton and to guarantee protection from major flood risk by 2023. Moreover, the necessary coordination with France to cover the full watershed of the rivers has been initiated since 1995, to match the geophysical reality of risks beyond national borders. This will be illustrated by both upscale and downscale benefits with (1) the Swiss national regulating framework being inspired by the canton's regulation and (2) a concrete example of a company investing in a mixed grey and NBS flood protection thanks to the mandatory flood risk assessment.

Case study: NBS as a landscape and public space strategy

Annelies De Nijs, Agence ter Paris, France

In landscape architecture and territorial design, NBS are being implemented more substantially in the design projects. The point of view from the designer, as someone who will reshape a territory and a living environment for its inhabitants, is therefore crucial. While leaving behind the strict problem-solving attitude, often responded to with a technical solution, a design project can create opportunities to transform a space and integrate other (ecological, recreational, educational, ...) aspects. From experiences in various contexts, Agence Ter will showcase some project experiences where particular hazards, public spaces or design processes have given way to innovative solutions in the field. The different challenges and opportunities will be discussed

The role of insurance to protect natural assets and enable more nature-based solutions

Elaine O'Brien, Swiss Re

More than half the world's GDP (\$44 trillion), is dependent on nature and the services that it provides. Hence, we should value and protect natural assets and eco-services in the same way we value, protect and insure other property, infrastructure and services. Insurance absorbs the shocks and costs of the unexpected and helps remove risk and build resilience - which can make investment in nature-positive initiatives more attractive. This presentation provides examples of different applications of insurance to protect natural assets and enable more nature-based solutions.

Thematic sessions: core questions

What NBS related skills and capacities need to be developed to upscale the private sector/nature-based enterprises? How can synergies between different types of expertise necessary for NBS implementation be fostered? What are the priorities? How do contractors define gaps for NBS projects preparation? What type of facility could support private sector upscaling?

What are the barriers/policies in place that hinder NBS upscaling? What new policies/instruments can support it? How can we get significantly increasing funding for NBS upscaling and capacity development?

Registered participants

	Name	Organization	E-mail
1	Adriana Duarte	ICLEI Europe	adriana.duarte.9876@gmail.com
2	Alberto Fresolone	International Institute for Applied Systems Analysis	fresolone@iiasa.ac.at
3	Alexey Azevich	Moscow City University	azevichai@gmail.com
4	Alhassan Ibrahim	James Hutton Institute	alhassan.ibrahim@hutton.ac.uk
5	Amy Oen	Norwegian Geotechnical Institute	amy.oen@ngi.no
6	Andrea Cadena	SEQUIL	andre30stm@hotmail.com
7	Andrea Staccione	Euro-Mediterranean Centre for Climate Change	andrea.staccione@cmcc.it
8	Anna Scolobig	University of Geneva	anna.scolobig@unige.ch
9	Annelies De Nijs	Agence Ter	adenijs@agenceter.com
10	Balázs Psenák	Penta-Kör Kft.	balazspsenak@gmail.com
11	Baptist Vlaeminck	City of Leuven	baptist.vlaeminck@leuven.be
12	Beatriz Fonseca	ICLEI	beatriz.fonseca@iclei.org
13	Bjorn Kalsnes	Norwegian Geotechnical Institute	bgk@ngi.no
14	Catarina Carvalho dos Santos	AdTA	ccdossantos@outlook.com
15	Cecilia Polacow Herzog	University of Lisbon	ceciliapherzog1@gmail.com
16	Cherie Gray	Swiss Re	cherie_gray@swissre.com
17	Chiara Pellegrini	EURAC Research	chiara.pellegrini@eurac.edu
18	Daisy Hessenberger	Arcadis	daisy.hessenberger@arcadis.com
19	Dessy Kadinova	European Commission	dessislava.kadinova@ec.europa.eu
20	Dorsa Sheikholeslami	International Union for Conservation of Nature	dorsa.sheikholeslami@iucn.org
21	Dr. Usharani RK	Independent Researcher, Academic, Bharathiar University, IN	usharaniks2003@yahoo.com
22	Edoardo Casarotto	European Commission	edoardo.casarotto@ec.europa.eu

23	Elise Buckle	Climate & Sustainability	ebuckle@climate-sustainability.org
24	Esmee Kooijman	Trinity College Dublin	esmee.kooijman@tcd.ie
25	Esther Carmen	The James Hutton Institute	esther.carmen@hutton.ac.uk
26	Fleur Van Ooststroom-Brummel	European Commission	fleur.van-ooststroom-brummel@ec.europa.eu
27	Gargi Chandane	University of Mumbai	gvchandane@gmail.com
28	Gerd Lupp	TUM School of Life Sciences - Chair for Strategic landscape Planning and Management	gerd.lupp@tum.de
29	Gloria Fernández Álvarez	Agbar	fdez.alvarez@gmail.com
30	Hallvard Skaare Nordbroden	Skred AS	hallvard@skred.as
31	Isobel Fletcher	Horizon Nua	isobel.fletcher@horizonnua.eu
32	Jason Jupiter	Energy Matters	jasonjupiter@gmail.com
33	Jelena Đokić	University of Belgrade	jelenamdokic@gmail.com
34	Jenan Irshaid	International Institute for Applied Systems Analysis	irshaid@iiasa.ac.at
35	JoAnne Bayer-Linnerooth	International Institute for Applied Systems Analysis	bayer@iiasa.ac.at
36	Jörg Balsiger	University of Geneva	joerg.balsiger@unige.ch
37	Jorge Castañer	South Pole	castaner.jorge91@gmail.com
38	Julia Aguilera Rodriguez	University of Geneva	julia.aguilera@etu.unige.ch
39	Juliette Martin	International Institute for Applied Systems Analysis	martinj@iiasa.ac.at
40	Juraj Jurik	Global Infrastructure Basel Foundation	juraj.jurik@gib-foundation.org
41	Karen Sudmeier	Th-Köln, University of Cologne, Germany	karen.sudmeier@gmail.com
42	Katrin Hüsken	BUND Deutschland e.V. / Friends of the Earth Germany	Katrin.huesken@bund.net
43	Lars briggs	Amphi int.aps	Lb@amphi.dk
44	Lars Staver Eid	Skred AS	lars@skred.as
45	Laura Franco	Inlecom Commercial Pathways	laura.franco@inlecomsystems.com
46	Lieke Huesken	TU Delft/deltares	l.m.huesken@tudelft.nl
47	Liping Dai	Utrecht University	l.dai@uu.nl
48	Mercedes Rois	Freelance	mercedes.bioeconomy@gmail.com
49	Mia Ebeltoft	Climate Risk Advisory	mia.ebeltoft@gmail.com
50	Muhammed Ali Güntay	Smartcitem	mhmmdlgnaty.25@gmail.com
51	Nathalie Nyssen	Firmenich	nathalie_nyssen@yahoo.com
52	Nea Pakarinen	ICLEI Europe	nea.pakarinen@iclei.org

53	Neha Miriam Kurian	United Nations Environment Programme	nehamkurian@gmail.com
54	Nicolas Faivre	European Commission	nicolas.faivre@ec.europa.eu
55	Nina Schonberg	Ulster Wildlife	nina.schonberg@ulsterwildlife.org
56	Peleg Bar-on	BioShade	bioshadetech@gmail.com
57	Ragnhild Hammeren	Skred AS	ragnhild@skred.as
58	Rik De Vreese	European Forest Institute	rik.devreese@efi.int
59	Ronan Donohoe	BaNG Capital Limited	ronan@bangcapital.co.uk
60	Sarah Bloor	Community Health Partnerships	s.bloor@communityhealthpartnerships.co.uk
61	Torrey Sanseverino	BeZero Carbon	torrey@bezercarbon.com
62	Victoria Blessing	Steinbeis 2i GmbH	victoria.blessing@steinbeis-europa.de
63	Vincent Farrelly	AquaRoot Technologies Ltd	v.farrelly@aquartec.com
64	Yoann Clouet	ISOCARP Institute	clouet@isocarp-institute.org

Organising team

Anna Scolobig, Julia Aguilera and Jörg Balsiger
 Environmental Governance and Territorial Development Institute
 University of Geneva
 Boulevard Carl-Vogt 66, CH-1205 Geneva, Switzerland | www.unige.ch/gedt/

JoAnne Linnerooth-Bayer and Juliette Martin
 Equity and Justice Group (EQU)
 International Institute for Applied Systems Analysis
 Schlossplatz 1, A-2361 Laxenburg, Austria | www.iiasa.ac.at

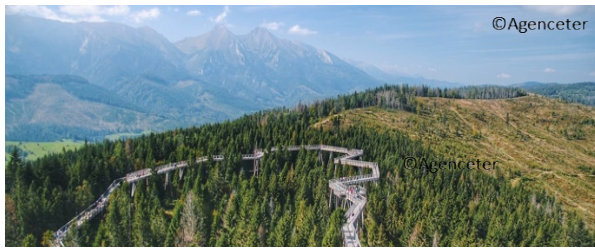
Victoria Blessing
 Network Nature
 Steinbeis Europa Zentrum
 Neue Adresse: Leuschnerstr. 43
 70176 Stuttgart, Germany
victoria.blessing@steinbeis-europa.de

Contact:
Anna.Scolobig@unige.ch

A4 Policy brief

This Policy Brief is a draft. It is currently being revised by copy editor and graphic designer.

Policy and finance innovation for nature-based solutions



The European Commission is investing considerably in NBS to position Europe as a leader for 'innovation with nature'. While ambition is growing, implementation remains problematic. Lack of expertise and knowledge, limited evidence on effectiveness and co-benefits, stakeholder conflicts, and grey measure path dependency represent formidable obstacles.

To address these areas, research done under the European Union's Horizon 2020 PHUSICOS Innovation Action Project suggests four recommendations to promote innovation in the NBS sector.

Updating European Member State policies and promoting mandatory policy instruments

This includes the enforcement of legally binding targets, and the simplification of NBS approval procedures. Further measures could include fostering policy synergies, for instance, by linking NBS policies to wellbeing and preventative health care policies.

Mobilizing public and private finance

This can be achieved by unlocking public and private funding to enable NBS investments, merging complementary funding streams into single programs that prioritize NBS, and promoting innovative financing mechanisms, such as payment for ecosystem services. Further actions could include divesting from nature negative projects.

Strengthening the knowledge base

Increased monitoring to track short- and long-term impacts, stronger evidence on the effectiveness of NBS, and co-benefit evaluation are key actions in this regard. The development of formal standards, such as insurance regulations and improved tools to compare NBS, hybrid, and conventional solutions, will further contribute to a strong knowledge base.

Building capacity

Capacity in this field can be expanded and strengthened through the creation of NBS project preparation facilities, accelerator programs/mentoring, user-friendly benefit/co-benefit catalogues for the private sector, and the creation of communities of practice for NBS contractors with the public, academia, and civil society.

Making the case for nature-based solutions

For NBS implementation to become more widespread and effective, it is essential to transform governance structures and to create appropriate legal, institutional, political and financial conditions. While ambition at the international level is growing, policy development at national and regional levels, as well as NBS upscaling at local level are often problematic. Current policies, regulations and path dependency from grey solutions often create substantial hurdles (Martin et al. 2023). Often, agencies and communities find funds for NBS insufficient or financing processes difficult to navigate or access. Also, the distribution of funding for green and grey measures is still very unequal. Likewise, private sector expertise to design and build NBS lags in many regions (Linnerooth-Bayer et al. 2023). Specialized NBS companies and business skills are rare. Finally, technical challenges, information deficits and uncertainties related to NBS effectiveness can also represent formidable obstacles, together with a lack of quantitative measurable targets for NBS deployment and quality (White House 2022).

During the PHUSICOS project, over 70 stakeholders were involved in deliberations through interviews, web meetings/e-consultations, and workshops. They set out to address questions including what changes are needed to catalyze NBS implementation; what role the private and public sector play, and how they can collaborate; as well as how innovation can be promoted. Based on the results of this stakeholder engagement, we provide four recommendations, accompanied by suggested innovations (Scolobig et al. 2023).

Update EU Member State policies and promote mandatory policy instruments

To date, despite many EU policy initiatives acknowledging the significance of NBS and having the potential to enable their implementation, these often remain voluntary with no legal obligations to comply. This leads to fragmented NBS adoption and limits the opportunities for implementation. Mandatory policy instruments, for example, making NBS compulsory elements of landscape planning, making the evaluation of NBS options a requirement of infrastructure projects, or streamlining simplified NBS approval procedures, through, for example, the introduction of self-certification schemes, could be further promoted.

Another example is the protection of a proportion of land for forest cover in EU Member States, as proposed in the EU Restoration Law. Furthermore, there is potential to build policy synergies, for instance, by linking NBS policies to wellbeing and preventative health care policies or to green infrastructure, transport, and mobility policies. Cross-sectoral integration of NBS and related concepts is also key to generate concrete implementation actions. A policy instrument example could be the co-development of joint biodiversity and climate plans at regional or national level. In parallel, trade-offs cannot be overlooked. They may occur, for example, when seeking biodiversity conservation and urban development goals, such as promoting NBS and providing opportunities for new development, housing, or parking.

Mobilize public and private finance

Insufficient funding, unbalanced distribution of funding for green and grey measures, and investments in nature-negative projects are barriers hindering NBS from fulfilling promises. Path dependencies on so-called grey measures and “green washing” further add to the problem, hindering NBS implementation and indirectly affecting public and private finance decisions. Moreover, the identification of ‘bankable’ projects presents a formidable challenge to private financing. Public authorities can simplify access to funding by increasing coordination and promoting synergies across different funding instruments. Innovative funding mechanisms (e.g., payment for ecosystem services) can help address significant costs that may be involved in the

implementation of certain solutions such as land acquisition. Divesting from nature negative projects is also a key priority, together with the promotion of co-financing options and public-private partnerships, for example, subsidies and tax rebates for NBS investment.

Another critical issue is de-risking NBS. Indeed, despite their manifold benefits, there are potential risks associated with the design, construction, and operation of NBS, which require a careful approach. Insurance and reinsurance schemes applied to NBS could play a significant role in spreading risks by covering, among others, risks of delays and budget overruns, as well as liability over their performance. Other risk-reduction alternatives include the participation of governments in the role of insurers or reinsurers to absorb a portion of the risks, as well as the possibility of introducing community-based insurance schemes or mechanisms.

Strengthen the knowledge base

The demonstration of NBS transferability, the lack of formal standards, the uncertainty in effectiveness evaluation, and the quantification of co-benefits are knowledge gaps that need to be addressed to broadly promote NBS. By outlining a set of evidence-based criteria, standards can assist in ensuring the quality, safety, and efficiency of interventions while supporting their long-term sustainability and minimizing the possibilities of unwanted social and environmental impacts. In some cases, given the contextual sensitivity of NBS, tailored standards for specific types of solutions may be called for. Furthermore, the multifunctionality of NBS could be better embedded in the assessment of risk reduction options.

Build capacity

Small and medium enterprises play a critical role as they are often responsible for various stages of NBS implementation. However, many of them encounter challenges ranging from a lack of NBS knowledge and basic business and marketing skills, to a lack of practical experience in implementing NBS. Overall, there is a lack of specialized enterprises.

The creation of an NBS project preparation facility (PPF) at the local and/or national scale, along with a user-friendly benefit and co-benefit catalogue for the private sector are options to support the development of the private sector. As a complementary approach, accelerator programs could offer start-ups great growth and learning opportunities through intensive funding and mentoring for a brief period. Backed by past experiences, training courses and seminars can also benefit contractors. Moreover, such tools can equally serve to effectively disseminate existing or emerging guidelines and to promote best practices.

We hope that these recommendations and suggested innovations will contribute to fostering debate, and supporting the uptake of NBS as key options in fighting climate change, biodiversity loss, and in reducing disaster risk.

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About this research and the PHUSICOS project

This work formed part of the PHUSICOS Innovation Action project funded by the EU Horizon 2020 research and innovation program (Grant agreement No. 776681; <https://phusicos.eu/>). PHUSICOS demonstrates how NBS provide robust, sustainable and cost-effective measures for reducing the risk of extreme weather events in rural mountain landscapes. This policy brief highlights the results of PHUSICOS Work Package 5, which specifically addresses governance innovation.

The Policy Brief reflects the authors' views and not those of the PHUSICOS partners or the European Community.

This Policy Brief is currently being revised by copy editor and graphic designer. The graphic summary of Del. 5.3. (see p. 11) will also be included in the final version of this Policy Brief.



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