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Bio Knowledge Agora: Developing the Science Service for European Research and Biodiversity

D2.2. A Science brief on policy instruments to support the EU Biodiversity Strategy for 2030

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Meaning / Full text
BDS2030	EU Biodiversity Strategy for 2030
CAP	Common Agriculture Policy
CSRD	Corporate Sustainability Reporting Directive
EU	European Union
EBVs	Essential Biodiversity Variables
EFRAG	European Financial Reporting Advisory Group
ESVD	Ecosystem Services Valuation Database
GBF	Kunming-Montreal Global Biodiversity Framework
GDPR	General Data Protection Regulation
IEEP	Institute for European Environmental Policy
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
KEN	Knowledge Exchange Networks
NbS	Nature-based Solutions
NRL	Nature Restoration Law
OECD	Organization for Economic Co-operation and Development
PES	Payment for Ecosystem Services Schemes
R&I	Research & Innovation
REDD+	Reducing Emissions from Deforestation and forest Degradation (with conservation and management of carbon stocks)
SEEA EA	System of Environmental-Economic Accounting — Ecosystem Accounting
SSBD	Science Service for Biodiversity
TNFD	Taskforce on Nature-related Financial Disclosures

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BACKGROUND: ABOUT THE BIOAGORA PROJECT

BioAgora is a collaborative European project funded by the Horizon Europe programme. It aims to connect research results on biodiversity to the needs of policy making in a targeted dialogue between scientists, other knowledge holders and policy actors.

Its main outcome will be the development of a Science Service for Biodiversity. This new service will fully support the ecological transition required by the European Green Deal and the European Union's Biodiversity Strategy for 2030.

The BioAgora project was launched in July 2022 for a duration of 5 years. It gathers a Consortium of 22 partners, from 13 European countries, led by SYKE, the Finnish Environment Institute. Partners represent a diversity of actors coming from academia, public authorities, SMEs, and associations.

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FOREWORD: CONTRIBUTION OF THE DELIVERABLE TO THE SSBD

The insights emerging from this science brief directly inform the development of the Science Service for Biodiversity (SSBD) resulting from the BioAgora project. As presented here, our interviews with varied organizations identified recurring challenges for biodiversity policy implementation, including uncertainty, limited resources, complex communication, and siloed governance; these issues were also highlighted in other BioAgora deliverables and related peer-reviewed publications (e.g., Lenti et al., 2025). The SSBD addresses these concerns while fostering collaborative stakeholder engagement and improved data use, closely aligning with the set of six recommendations (R1-R6) presented in this deliverable.

Several core SSBD mechanisms are uniquely positioned to take up the findings here presented, namely:

- **Answering Request Function:** Translates scientific knowledge into policy-relevant insights, reducing uncertainty and clarifying complex issues for decision-makers.
- **Centralized Web Platform:** Improves access to biodiversity expertise, tools, and datasets, supporting actors with limited capacity and reducing information fragmentation. Together, these mechanisms are pivotal for implementing recommendations like R2, R3, and R5.
- **Knowledge Exchange Networks (KENs):** These thematic networks create structured dialogue among scientists, policymakers, practitioners, and civil society, helping overcome siloed approaches (R1, R4). Furthermore, the SSBD promotes inclusive knowledge exchange as a core ethical principle, ensuring that underrepresented local actors and diverse knowledge holders inform decision-making processes (R2, R6).

The SSBD further supports ongoing policy practices for biodiversity through specific KEN activities. For instance, knowledge synthesis mechanisms help strengthen the integration of Nature-based Solutions (NbS) into planning instruments (R2). This was recently demonstrated by the NbS KEN's response to DG ENV requests, which provided practical evidence to municipalities implementing the Nature Restoration Law (NRL). Similarly, the SSBD facilitates crucial dialogue on harmonizing biodiversity metrics across corporate reporting and financial instruments (R3). In this regard, the Monitoring KEN serves as a central platform to connect standardization initiatives – as witnessed with the local-scale NbS monitoring work carried out within NetworkNature+ Task Force 1.

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EXECUTIVE SUMMARY

This document is the deliverable of Task 2.2 from the BioAgora Project, funded under the European Union's Horizon Europe research and innovation programme under the grant agreement No 101059438. The deliverable is presented as a standalone science brief, in the sense that it offers an overview of current policy instruments and approaches to support the governance of biodiversity issues, in line with the targets of the Biodiversity Strategy to 2030 (BDS 2030), but still presents a few recommendations on how these instruments can be improved or better supported by actions at the science-policy-society interface.

Our analysis was based on data collected through semi-structured interviews with fifteen organizations, strategically selected. By adopting a semi-structured approach, we aimed to capture both the depth and breadth of insights from participants, facilitating a comprehensive understanding of the subject matter. The interviewees were asked to discuss the policy instruments supported by their work within the organization (in relation to EU Biodiversity Strategy targets), as well as implementation challenges and opportunities they are aware of. To analyze the data, we developed a framework for policy analysis and policy tool assessment. The framework is based on the OECD's policy coherence framework for sustainable development (OECD, 2016) and has been tailored to meet the objectives of Task 2.2. We further substantiated some of the topics covered in our interviews with a snowball literature review, to derive a few practical recommendations.

This science brief can be useful in different ways to different target audiences. In general, it provides a few insightful take-home messages and practical recommendations on some of the main challenges and opportunities currently associated with policy approaches to achieve biodiversity targets. For researchers and practitioners working in the EU science-policy-society interface, the insights presented in Section 4 may indicate relevant leverage points that should be explored in future research for more effective biodiversity conservation and enhancement. For policy-makers, the recommendations provided in Section 5 may shed light on relevant potential implementation barriers and pathways for improvement, which can help refine biodiversity policies to be more practical and effective at ground level. Notwithstanding, given the limited sample size of organizations engaged with, we emphasize that the messages produced in this science brief should be interpreted as wide-ranging insights that cover various types of policy instruments employed across different BDS 2030 targets, and not as in-depth solutions to specific instruments or targets.

NON-TECHNICAL SUMMARY

This document is a science brief and it summarizes the results of a research task dedicated to exploring the different policy instruments being employed to address the targets of the EU Biodiversity Strategy 2030, and to understanding what are the current main challenges and opportunities that different European organizations are facing in their work to support the design or implementation of these instruments.

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CONTENTS

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A SCIENCE BRIEF

Assessing policy instruments to support the EU Biodiversity Strategy 2030 targets: implementation challenges and opportunities

1. Aim

The EU Biodiversity Strategy for 2030 (BDS 2030) aims at addressing the ongoing biodiversity crisis and ensuring the resilience of ecosystems, advancing a variety of targets (Figure 1) to protect nature and restore damaged ecosystems. To achieve these ambitious targets, a range of policy approaches and instruments is available to policy actors to promote conservation, restoration and enhancement of biodiversity. The design and implementation of these instruments is being supported, either directly or indirectly, by various organizations in the science-policy-society interface, whose actions and initiatives play a significant role in the successful achievement of the BDS 2030 targets.

The aim of this brief is twofold: (1) to provide evidence and a better insight into the policy approaches and instruments being supported by the different types of organizations operating at the science-policy-society interface; and (2) to identify the main challenges and opportunities in the sustainable solutions being advanced by these organizations in support of BDS 2030 targets, highlighting some innovative examples and potential trade-offs at stake.

This brief is an output of the BioAgora project (European Commission Horizon Europe programme No. 101059438). BioAgora is developing the Science Service for Biodiversity, which will be the principal mechanism connecting biodiversity knowledge with the needs of policy-makers, while also mainstreaming the knowledge base for decision-making. The reflections contained in this brief intend to provide a better understanding of how organizations at the science-policy-society interface support and perceive biodiversity policy instruments, thus contributing to transforming processes between science, policy and society. The findings here presented reflect the views and experience of the interviewees and not necessarily those of the organization to which they belong.

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THEMES	ASSOCIATED TARGETS
PROTECTION AND MANAGEMENT OF NETWORK OF PROTECTED AREAS	**Target 1** |Legally protect a minimum of 30% of the EU's land area and a minimum of 30% of the EU's sea area, and integrate ecological corridors, as part of a true Trans-European Nature Network **Target 2** | Strictly protect at least a third of the EU's protected areas, including all remaining EU primary and old-growth forests **Target 3** | Effectively manage all protected areas, defining clear conservation objectives and measures, and monitoring them appropriately
LEGAL FRAMEWORK FOR RESTORATION OF NATURE (ENFORCEMENT AND IMPLEMENTATION)	**Target 4** | Legally binding EU-l targets: By 2030, significant areas of degraded and carbon-rich ecosystems are restored; habitats and species show no deterioration in conservation trends and status; and at least 30% reach favorable conservation status or at least show a positive trend **Target 17** | Stepping up implementation and enforcement of EU environmental legislation
AGRICULTURE, POLLINATION, AND REDUCTION OF PESTICIDES	**Target 5** |The decline of pollinators is reversed **Target 6** | The risk and use of chemical pesticides is reduced by 50%, and the use of more hazardous pesticides is reduced by 50% **Target 7** | At least 10% of agricultural area is under high-diversity landscape features **Target 8** | At least 25% of agricultural land is under organic farming management, and the uptake of agroecological practices is significantly increased **Target 13** | The losses of nutrients from fertilizers are reduced by 50%, resulting in the reduction of the use of fertilizers by at least 20%
AFFORESTATION	**Target 9** | Three billion additional trees are planted in the EU, in full respect of ecological principles
FRESHWATER ECOSYSTEMS	**Target 11** | At least 25,000 km of free-flowing rivers are restored
MARINE ECOSYSTEMS	**Target 15** | The negative impacts on sensitive species and habitats, including on the seabed through fishing and extraction activities, are substantially reduced to achieve good environmental status **Target 16** | The by-catch of species is eliminated or reduced to a level that allows species recovery and conservation
LAND TAKE AND SOIL ECOSYSTEMS	**Target 10** | Significant progress in the remediation of contaminated soil sites
INVASIVE SPECIES	**Target 12** | A 50% reduction in the number of Red List species threatened by invasive alien species
GREENING URBAN AND PERI-URBAN AREAS	**Target 14** | Cities with at least 20,000 inhabitants have an ambitious Urban Greening Plan
TRANSFORMATIVE GOVERNANCE	**Target 18** | European biodiversity governance framework (including a clear set of agreed indicators and will enable regular progress assessment and set out corrective action if necessary, The Commission will assess the progress and suitability of this approach in 2023, and consider whether a legally binding approach to governance is needed.)

Figure 1: The Biodiversity Strategy Targets (BDS 2030) organized by 10 themes, as identified in the work developed in Deliverable 1.1 of BioAgora project (https://doi.org/10.5281/zenodo.7685651).

2. Policy approaches and instruments for biodiversity governance

Biodiversity and ecosystem governance can build on a wide range of policy instruments, which according to IPBES (2018:672) [(IPBES, 2018)] can be broadly placed into four main categories (Figure 2): **Legal and regulatory instruments** ("command and control" measures usually applied to deal with environmental degradation); **Economic and financial instruments** (price- or quantity-based mechanisms intended to change the behavior of public and private investors); **Social and information-based instruments** (information-, education-, and certification-based mechanisms that highlight the relevance of socio-cultural dynamics to environmental conservation); and **Rights-based and customary norms instruments** (measures that integrate indigenous and local community rights, norms, standards, and principles into policy, planning, and implementation).

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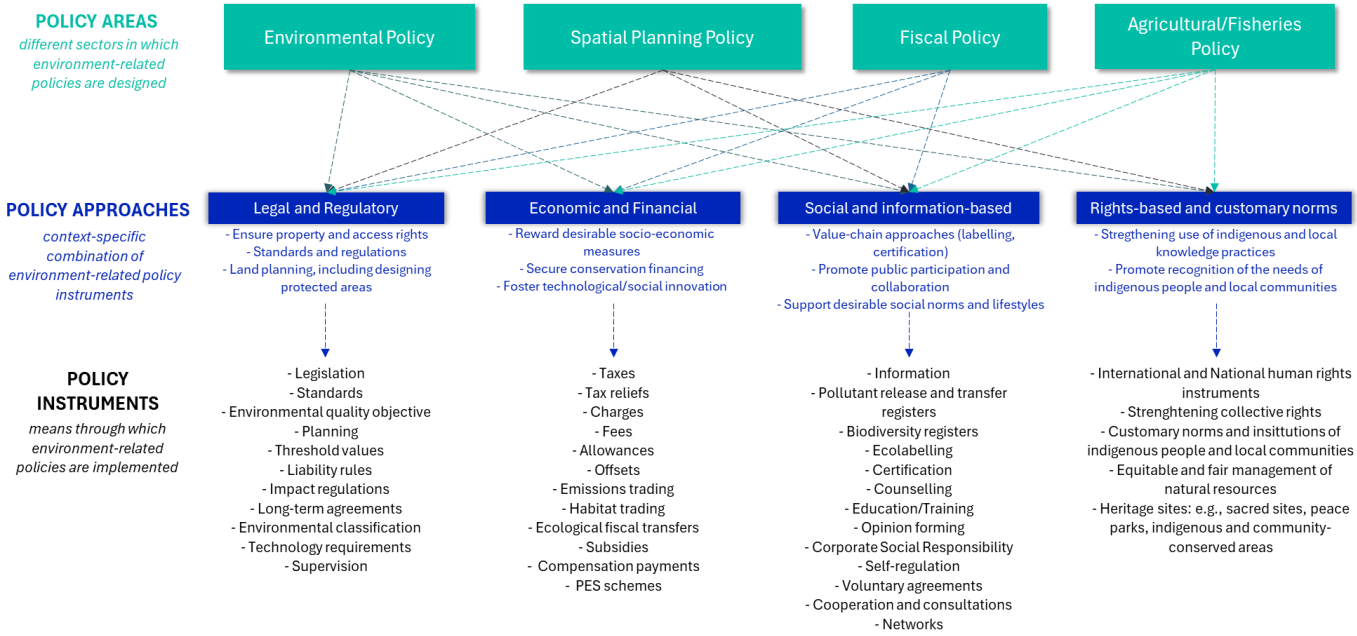

Figure 2: Hierarchical representation of policy areas, policy approaches and policy instruments related to biodiversity conservation, restoration, and enhancement. Inspired by [(D'Amato et al., 2022; IPBES, 2018)]

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3. Where does our data come from?

A set of semi-structured interviews were conducted with 15 organizations deemed relevant among the ones mapped in the social network analysis developed by BioAgora Deliverable 2.1 (Figure 3). The interviews followed a script with a combination of closed and open-ended questions focused on understanding: (1) which BDS 2030 targets are being addressed by different organizations; either directly or indirectly (Figure 4); (2) which policy instruments are being supported by the work of different organizations to address these targets; and (3) what are the main challenges and opportunities encountered in implementing or supporting such tools. Interviews were analyzed using inductive coding (Boyatzis, 1998), and a SWOT-based analysis was performed to assess the challenges and opportunities of implementing the different policy tools that were identified, which are presented in Section 4.

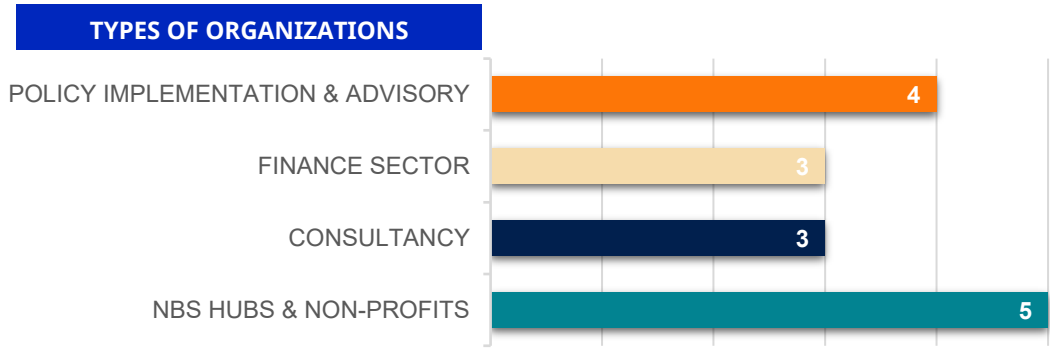

Figure 3: Number of organizations interviewed organized by organization type.

Our interviews were conducted with organizations identified through the network mapping exercise developed in BioAgora (D'Amato, Rantala, Korhonen-Kurki, et al., 2025).The selection focused on actors operating at the European level and/or positioned within the science–policy–society interface, in order to understand how biodiversity-related policy instruments are supported by and perceived within this governance space. The selection of organization/networks to engage with has been guided by defined criteria and by leveraging a shared project dataset. The criteria for selection included (1) Network must be ongoing; (2) Network must be biodiversity focused; (3) Network must be influential (according to Eklipse); (4) Coverage to guarantee analysis of as many types of networks as possible.

Specifically, the *policy implementation & advisory* typology includes interviews with a few DG officials (DG Env and DG RTD), the IEEP, and one advisory office related to Maritime Affairs in Portugal. The *finance sector* interviews included representatives from TNFD, Capitals Coalition and Finance 4 Biodiversity. The *consultancy sector* interviews included representatives from private environmental consultancies in Bulgaria and Italy, as well as the ESVD/Foundation for Sustainable Development. The *NbS hubs and non-profits* interviews included representatives from four different NbS hubs (Nordic, Hungary, Portugal and Italy) and the Baltic Environmental Forum from Latvia.

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The sample is therefore purposive rather than statistically representative of the full diversity of public administrations, implementing bodies and supporting networks across EU Member States. The goal of our sampling strategy was not to quantify the relative prevalence of policy instruments across all governance levels, but to capture the perspectives of different organizations that play a strategic role in connecting biodiversity knowledge, policy development, and implementation processes in Europe, at different scales. This design complements more in-depth analysis conducted in other BioAgora tasks (D'Amato, Rantala, & Korhonen-Kurki, 2025; Lenti et al., 2023) addressing subnational and local dynamics, and should be interpreted as providing exploratory and qualitative insights into challenges, and opportunities emerging within the science-policy interface that can be relevant to achieving the EU Biodiversity Strategy for 2030 targets (Section 4. Key findings).

While the interviews were exploratory by nature, they consistently highlighted specific claims, (i.e., the challenges and opportunities mentioned above) affecting the design or implementation of a few policy instruments that are addressing the BDS 2030. We then consubstantiated these claims with a snowball literature review (Wohlin, 2014; Wohlin et al., 2022). Specifically, we took as a starting point the key claims identified in our interviews per policy approach (as seen in Figures 7 and 8). We formulated one individual search string for each of these claims, separately, using the following logic: {"biodiversity" AND "policy" AND ("term1" OR "term2" OR … "term x")}. The terms used were pooled from the inducive coding exercise, directly related to the interview transcripts. This resulted in a total of 15 unique search strings, that were input in Web of Science, Scopus and Google Scholar with a post-2021 filter. Given the high interdisciplinary nature of our searches, covering topics cutting across legal, financial, and social issues, we screened the first 25 results for each search string and, based on expert judgment, selected from three to ten publications per claim, based on title, abstract, journal and authors profiles (e.g., high impact journals, highly cited authors in their respective fields). In addition, key working documents and official reports from widely acknowledged international institutions were also considered. We then fully screened these selected publications and worked backwards from the reference list (backward snowballing) to expand on specific issues mentioned in the original publications.

This resulted in a total of 84 publications being consulted, and this approach allowed us to provide a concise set of recommendations that expand on the claims collected in our interviews to strengthen existing policy instruments for biodiversity, focusing for instance on innovative and practical improvements in regulatory design, financing mechanisms, data infrastructure, and institutional coordination (presented in Section 5).

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4. Key findings

The interviewed organizations do not directly address all BDS2030 targets

BDS2030 targets related to protected areas, nature restoration and urban greening themes are the ones most directly addressed by the organizations interviewed (Figure 4). Themes like Invasive Species (Target 12), Freshwater ecosystems (Target 11) and Soil ecosystems (Target 10) are only directly addressed by one organization, and therefore limitedly covered in our interviews. Finally, the Transformative Governance theme (Target 18) is not directly addressed by any organization interviewed. Interviewed *NBS Hubs and non-profits* organizations are directly addressing most of the themes of BDS2030 targets, as opposed to the finance sector organizations which directly address only a few themes, namely restoration, protected areas and invasive species.

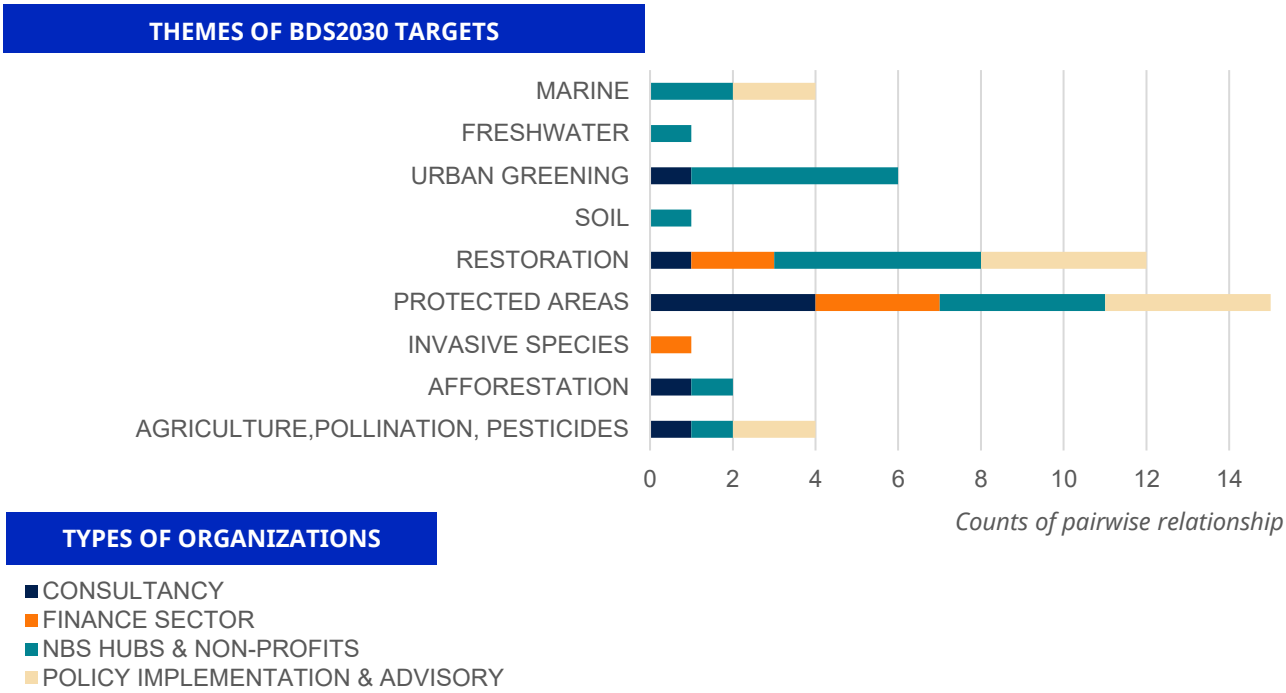

Figure 4: Targets (organized by themes) directly addressed by the different organizations interviewed (organized by type) Chart shows count of pairwise relationships – i.e., one target directly addressed by one organization. Organizations could directly address multiple targets.

Most organizations interviewed indirectly address or support all of the BDS2030 targets. Notwithstanding the direct contributions analyzed above, interviewees from *Policy implementation & advisory* and from *NBS Hubs & Non-profits* have stated their organizations also indirectly contributes to address or support all of the BDS2030 targets. The interviewees from the *Finance sector* organizations have recognized indirect support to all BDS2030 targets except Urban Greening (Target 14). Contrastingly, the *Consultancy* organizations interviewed have recognized indirect contributions to almost all themes of targets, except Soil ecosystems (Target 10), Invasive Species (Target 12) and Transformative Governance (Target 18).

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Main policy instruments engaged with at the science-policy-society interface for biodiversity protection or enhancement

Most of the instruments supported by the interviewed organizations to address the BDS 2030 targets relate to *Social & Information-based* approaches (51%) (shades of blue instruments **in Figure 5**). Instruments under *Legal & Regulatory* approaches are also well supported (29%, shades of red), with a few legal or regulatory instruments mentioned by each category of organization. *Economic & Financial* instruments (15%, shades of green) are mostly supported by the consultancy sector. Instruments under *Rights-based and Customary Norms* approaches are still emerging (5%, shades of grey), with minor references to co-management by organizations from the policy and consultancy sectors, for example.

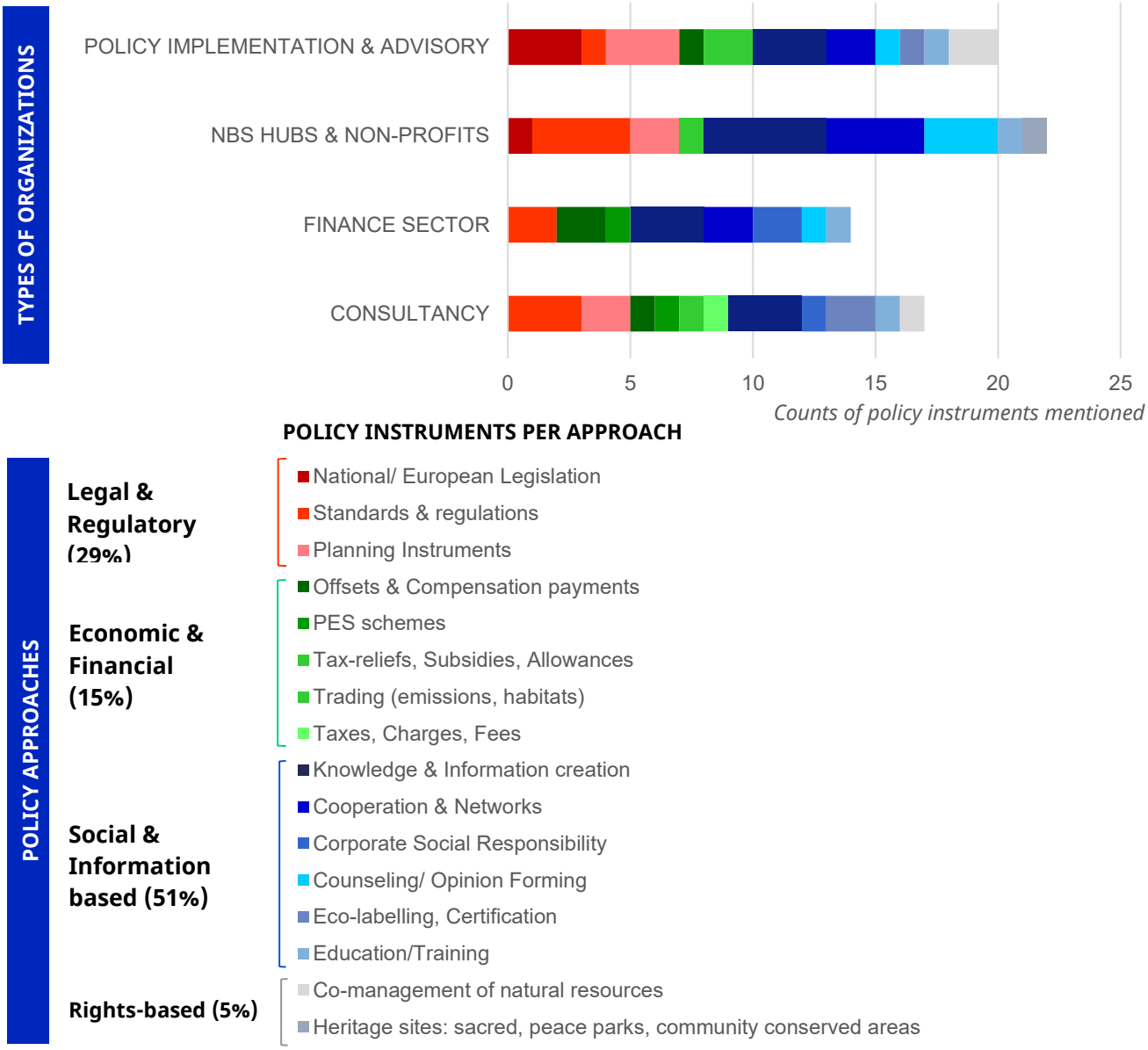

Figure 5: Counts of policy instruments supported by the different organizations interviewed. Color code refers to the policy approaches of the instruments (shades of red = legal & regulatory approaches; shades of green = financial & economic approaches; shades of blue = social and information- based approaches; and shades of grey = rights-based and customary norms approaches). The percentages represent the share of policy instruments mentioned in all interviews per policy approach (n=73).

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There was no mention of *economic & financial instruments* directly addressing BDS 2030 targets related to protected areas, to marine ecosystems or to urban greening, which are mainly supported by *legal & regulatory* and *social & information-based* instruments (Figure 6). Instruments under *economic & financial approaches* were mainly related to nature restoration targets, though a few examples of such instruments applied to agriculture-related targets and afforestation were mentioned. Only a few examples of instruments addressing targets related to afforestation, freshwater ecosystems, land-take/soils, and invasive species have been provided. No instrument was mentioned in the interviews in support to targets related to biodiversity governance (Target 18). The distribution presented in Figure 6 reflects instruments most frequently mentioned by interviewed organizations, and does not necessarily represent the proportional use of instruments across EU biodiversity governance.

		POLICY APPROACHES			
		LEGAL & REGULATORY	ECONOMIC & FINANCIAL	SOCIAL & INFORMATION-BASED	RIGHTS-BASED & CUSTOMARY NORMS
THEMES OF BDS 2030 TARGETS	PROTECTED AREAS	●●●●●●		●●●●●●	●●
	RESTORATION	●●●●●●●	●●●●	●●●●●●●●●	
	AGRICULTURE, POLLINATION, PESTICIDES	●●●	●●	●●●●	
	AFFORESTATION	●	●		
	MARINE	●●●●		●	●
	FRESHWATER			●	
	LAND TAKE/ SOIL			●	
	INVASIVE SPECIES			●	
	URBAN GREENING	●●●●●●●●		●●●●●●●●●●	●
	GOVERNANCE				

Figure 6: BDS 2030 Targets (organized by themes) being addressed through the various policy instruments (organized by approaches) supported by the organizations interviewed. Each dot represents one example of an instrument as provided in the interviews. The distribution reflects instruments most frequently mentioned by interviewed organizations and does not necessarily represent the proportional use of instruments across EU biodiversity governance.

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Challenges to the effective implementation of policy instruments for biodiversity

The most mentioned challenges for the successful implementation of policy instruments to address BDS 2030 targets were found to cut across different policy approaches, and they include uncertainty, lack of resources, and "*missing pioneers*" (Figure 7). The implementation of *rights-based and customary* norms instruments was found to be **emerging** and no substantial challenges have been highlighted in our interviews. Each challenge is further explained after the figure.

	POLICY APPROACHES		
MAIN CHALLENGES MENTIONED	Legal & Regulatory	Economic & Financial	Social & Information
Uncertainty			
"*Missing Pioneers*"			
Lack of resources/Undercapacity (data/skills)			
Complex Communication			
Silos thinking/ Need for Harmonization			
Insufficient efforts or regulations			

Figure 7: Main challenges for implementing current policy instruments for biodiversity, as mentioned by the interviewed organizations. Challenges mentioned more than twice per policy approach in our interviews are labelled dark red, indicating increased prevalence (potentially more concerning issues). Challenges mentioned once or twice per policy approach are labelled light red. Absence of color indicates no mention.

Uncertainty | For *economic & financial instruments*, uncertainty relates mostly to private agents and investors being still unclear about the long-term return on investments on biodiversity conservation/enhancement, or about the growth opportunities that can emerge from taking part in compensation mechanisms and PES schemes, which is particularly aggravated by changing political will and volatile markets. For *legal & regulatory instruments*, uncertainty relates to the unclear outcomes of the implementation of specific regulations due to lack of straightforward cause-effect evidence for biodiversity restoration/enhancement, which affects agents such as fishers or farmers. For *social and information-based instruments*, uncertainty refers to unclear mechanisms for ensuring continuous science-policy cooperation, when most initiatives for biodiversity restoration and

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enhancement require long-term commitment that lasts longer than administrative cycles, and success is left at the chance of finding fortuitous "motivated agents" along the way.

"Missing pioneers" **|** For *economic & financial instruments*, the lack of pilot initiatives ("*missing pioneers*") that was identified refers, for instance, to the need for more vested interest from Member-States to push for green accounting initiatives, paving the way for the establishment of standards and standardized methodologies, as well as the need for more successful examples of blended finance mechanisms for achieving biodiversity restoration and enhancement, to counteract risk aversion from private investors (BOX 1). For *social & information-based instruments*, the "missing pioneers" challenge identified refers to not only the need for more concrete and on-the-ground examples of successful nature-based solutions (NbS) with positive outcomes for biodiversity, but also to the need for more businesses to show up and communicate the added-value of understanding their dependencies and impacts on biodiversity, rather than seeing Corporate Sustainability (CSRD) and similar reporting as a mere obligation or requirement.

Lack of resources (data/skills) **|** For *social & information-based instruments*, lack of resources identified refers both to lack of data and/or skills from businesses and some Member States to disclose quantitative and robust biodiversity-related information (e.g.: undercapacity and inability to access information) and also to the lack of financial and human resources available to local administrations to carry on knowledge and information creation related to biodiversity beyond the lifespan of R&I projects. This includes also, for example, insufficient administrative capacity for monitoring NRL targets at local/regional level. For *economic & financial instruments*, it refers to the lack of standardized metrics that can adequately showcase positive impacts on biodiversity, currently deterring private investors. For *legal & regulatory instruments*, lack of resources refers mainly to the undercapacity of some Member States to implement and monitor regulations as imposed by EU legislation ("*unrealistic timings*").

Complex topic/communication **|** For *legal & regulatory instruments*, we identified that the complexity of biodiversity as a concept results in challenges to adequately translate and capture biodiversity into legislation. Some pieces of legislation or regulations currently rely on concepts that are still not well-defined and/or are oversimplified (for communication and easiness of use), decreasing its reliability as scientific evidence and potentially impacting the expected outcomes of their implementation. For *economic & financial instruments*, it relates to the difficulties in adequately capturing biodiversity values in the metrics used to support market-based instruments. For *social & information-based instruments*, such as knowledge creation for the implementation of NbS or CSRD reporting, it has been noted that the majority of actors working in public administration and in the private sector are much less versed in biodiversity than they are in other environmental topics such as climate change, being a particular complex topic to be handled by local administrations or by businesses. This difficulty is evident, for instance, in the struggle to mint a common terminology among practitioners, decision-makers, and scientists to create standards, determine thresholds and identify suitable indicators for monitoring and reporting on biodiversity.

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Silo-thinking/harmonization | For *legal & regulatory instruments*, the identified silo-thinking refers mainly to a lack of integration of sectoral policies in relation to biodiversity governance, as highlighted by interviewees working in marine contexts (though also applicable to inland contexts). For *economic & financial instruments*, it refers mainly to calls for more standardized and harmonized metrics for biodiversity across different finance-related instruments, not only to facilitate the uptake of voluntary disclosures and markets, but also to enhance the assessment of true additionality (financial, social, and ecological) of investments in biodiversity. For *social & information-based instruments,* it refers mainly to difficulties in cooperation, data sharing and co-creation among various actors, such as different departments in administration offices or between public bodies and the private sector (e.g., financial institutions). This self-centered focus creates difficulties in achieving a shared common vision to align development objectives and to support biodiversity restoration and enhancement more efficiently.

BOX 1 | The "missing pioneers" for improved *economic & financial instruments* for biodiversity conservation, restoration and enhancement in Europe

Many examples of **blended finance solutions for nature restoration** - catalyzing public, private and philanthropic investments - have been developed in the past decade, with more emerging in light of the Kunming-Montreal Global Biodiversity Framework (GBF). However, there is still a need to demonstrate to private investors that these solutions can be sufficiently insulated from economic downturns and changings in political will, through strong policies that institutionalize standardized tools and processes to ensure the availability of continuous and consistent funding for biodiversity restoration and enhancement. Pilot projects to showcase the benefits of these solutions to both private investors and nature are still few. Access to these solutions should be stripped of excessive bureaucracy and accelerated for such small, pilot-projects that can pave-the-way for more ambitious investments. Evidence-based quantification of biodiversity benefits and ROI estimates should help boost the uptake of such financing solutions.

A particular example for co-financing biodiversity restoration and enhancement in urban settings includes the use of **EU R&I funds** to oversee the implementation of pilot projects on Nature-based solutions (contributing to Target 14). These projects run from design to infrastructure development and construction, with the latter being co-financed by local administrations and other relevant private actors that will directly benefit from these solutions (e.g., water management companies), facilitating science-policy cooperation, promoting engagement and ensuring the implementation of evidence-based biodesign solutions that maximize social and environmental benefits for the city.

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Opportunities for the effective implementation of policy instruments for biodiversity

The most mentioned opportunities for the successful design/implementation of policy instruments to address BDS 2030 targets cut across different policy approaches, and include collaboration, engagement, and acting on the value chain (Figure 8). A few opportunities for advancing rights-based instruments have also been identified. Each opportunity is further explained after the figure.

MAIN OPPORTUNITIES MENTIONED	POLICY APPROACHES: Legal & Regulatory	Economic & Financial	Social & Information	Rights-Based & Customary Norms
Collaboration				
Engagement & Commitment				
Acting on the value chain				
Improved funding schemes				
Improved data				

Figure 8: Main opportunities for implementing policy instruments for biodiversity, as mentioned by the interviewed organizations. Opportunities mentioned more than twice per policy approach in our interviews are labelled dark green, indicating increased prevalence (potentially more beneficial actions). Opportunities mentioned once or twice per policy approach are labelled light green. Absence of color indicates no mention.

Collaboration | For *social & information-based instruments*, collaboration refers to potentially available channels for data-sharing between public administrations and financial institutions, which can improve CSRD reporting and similar initiatives (e.g., disclosure of the location of facilities where different businesses operate, which is known to public administrations via permits, licensing, and other legal requirements). It also refers to massive efforts in standardizing methodologies for collecting biodiversity data, to advancing innovative solutions through collaboration among different public offices or with R&I projects, or to the creation of aggregating agencies at the Member-state level to oversee the collection of biodiversity data, all of which stemming from high levels of cooperation among different actors. For *legal & regulatory instruments*, opportunities for collaboration can be seen in the increasing EU efforts pushing for collaboration among actors both

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intra and inter sectors (BOX 2). For *rights-based & customary norms instruments*, collaboration refers to examples of co-management initiatives that can be seen for instance in a few coastal fishing communities, where academia, decision-makers and local organizations/actors are coming together to restore and enhance habitats and stocks.

Engagement & Commitment | For *social & information-based* instruments, engagement refers mainly to the high engagement and commitment levels currently displayed by a large number of local actors, including municipalities and citizens, involved in the implementation of NbS in urban settings. For *economic & financial instruments*, engagement opportunities refer to a few successful examples of businesses interacting with a wide range of stakeholders for constructive policy making and market regulation/reconfiguration. For *legal & regulatory* instruments, this includes a few successful examples of new regulatory requirements being introduced in formal local planning in urban contexts as a consequence of successful R&I projects that extensively engaged with local institutional actors for NbS implementation. For *rights-based instruments*, the engagement opportunities highlighted refer to recent efforts for integrating local and indigenous knowledge in biodiversity-related databases and in the design and implementation of NbS solutions.

Acting on the value chain | For *economic & financial instruments*, good examples linking environmental subsidies to proper investments in the creation of green labels and products provide an avenue for upscaling good environmental practices in the agrifood sector**.** For *social & information-based instruments***,** acting on the value chain was identified in relation to opportunities for rewarding forestry producers that are complying with environmental standards by reducing their bureaucratic burden, potentially supporting more just and competitive prices. It also referred to pioneer examples for engaging local communities in the creation of green labels and markets associated with positive environmental practices - such as “from your local fisherman” label initiatives, which provide a good opportunity for supporting the restoration and enhancement of coastal habitats and stocks.

Improved funding schemes | For *economic & financial instruments*, new or improved funding schemes refers to encouraging blended finance solutions to complement market mechanisms by involving the private sector and local/regional administrations, which includes improving accessibility to public funds for leveraging private investments in biodiversity restoration and enhancement. It also refers to ensuring that different financial instruments can be used by different actors depending on the context (promoting a culture of “funding mix”).

Improved data | Improvements in data collection processes through technology (e.g., advancements that allow better sampling and monitoring of pollinators) and scientific collaborations are currently central for better biodiversity conservation and monitoring in various sectors. For *social & information-based instruments* this includes, for instance, new decision support-systems that consider weather conditions and other parameters at the land parcel scale to optimize pesticide usage, or new quantitative evidence on the biodiversity benefits resulting from NbS implementation. In many aspects, it has been highlighted that information is increasingly available, and new ways of sharing, connecting, and analyzing this information are significantly contributing to monitoring and promoting biodiversity across different scales.

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BOX 2 | New opportunities for *legal & regulatory instruments* for biodiversity conservation, restoration , and enhancement in Europe

In Europe, biodiversity is protected and managed through a comprehensive framework of legal and regulatory instruments at both the European Union (EU) and national levels, including directives, regulations, standards and even planning instruments. However, past efforts have been insufficient to halt biodiversity loss and promote enhancement, which requires more systemic, adaptive, and integrated approaches.

With the recently passed EU Nature Restoration Law (NRL)[1], opportunities for potentially operating at ecosystem levels and ensuring a long-term perspective for nature restoration have been renewed. This binding legal instrument focuses primarily on the protection and restoration of habitats and of habitats for individual species, and it advances an ambitious set of time framed targets (and monitoring reporting) that is to be achieved through voluntary actions. In practice, Member States will thus likely turn to existing policy instruments under different policy areas, such as the Common Agriculture Policy (CAP) or Regional Development Funds, and reassign them to clearly address NRL targets, to build a resilient funding and implementation structure. As many of the drivers for biodiversity decline emerge, for instance, from land-use changes and agriculture land-use, further integrating NRL targets when implementing these sectoral policy instruments will be relevant for making progress on various BDS 2030 targets.

However, given the voluntary nature of the actions in the Nature Restoration Plans to be produced by Member States, it has been acknowledged that the successful implementation of NRL will require not only financial investments but also supportive institutions for cooperation, peer-to-peer learning, business models that support land-use change, and societal acceptance to work with nature (Hering et al., 2023), bringing focus to the need for orchestrating various policy approaches to achieve effective biodiversity restoration and enhancement. Focus should be given to the provision of appropriate resources and capacity-building for implementation and monitoring of the NRL, including the creation of standardized methodologies.

[1] http://data.europa.eu/eli/reg/2024/1991/oj

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5. Recommendations for improving the uptake and effectiveness of policy instruments for biodiversity

Building on the challenges and opportunities identified through the interviews with organizations operating at the science–policy–society interface, we translate in this section a few qualitative insights, substantiated by literature, into a set of six operational recommendations (R1-R6). These recommendations should be interpreted as evidence-informed proposals that are merely "scratching the surface", as they emerge from a range of actors engaged in supporting biodiversity targets in Europe, but are not necessarily covering all main issues arising across Europe. Here we frame these recommendations as enablers for more effective science–policy interaction for designing and implementing policy instruments that aim to address BDS2030 targets. They are presented below per policy approach.

LEGAL & REGULATORY INSTRUMENTS

Insights from interviews with policy advisors and NbS hubs revealed a critical legal and regulatory bottleneck that was discussed mostly in relation to Target 14 of BDS2030 (*Cities with at least 20-000 inhabitants have an ambitious Urban Greening Plan*). Interviewed actors emphasized that unless nature-based planning and environmental quality objectives are legally binding in local planning instruments, biodiversity consistently loses the "battle for land" to development in urban planning. This suggests that operationalizing urban greening for biodiversity requires a strengthened regulatory framework and different governance approaches. Substantiated by literature, we formulate two recommendations that can be addressed at the science-policy-society interface:

R1: Embed legally binding NbS requirements in municipal planning instruments

Recent literature highlights the tension between different types of policy instruments operating at the municipal scale - often categorized as regulatory "sticks," economic "carrots," and informational "sermons" (David et al., 2024). Notably, high-level EU frameworks like the BDS2030 are frequently classified as "sermons - i.e., non-binding, normative guidance that relies on persuasion rather than enforcement. This creates a profound implementation gap that has been long evidenced (Rinaldi, 2021), since ambitious action plans rarely establish the institutional, legal, and procedural framework conditions necessary for actual enforcement. This has been witnessed not only for biodiversity, as highlighted in our interviews, but also in relation to climate change adaptation goals (Bierwirth et al., 2024). The recommendatory nature of 'sermon' instruments, either at the EU or national level, leaves municipal planners disempowered and often limited to checking the legality of private development projects and not able, for instance, to demand that they incorporate green infrastructure for climate adaptation and/or for biodiversity enhancement. Empirical evidence from the Nordic context perfectly illustrates this dynamic. For example, Norway's central government planning guidelines state that Nature-based Solutions (NbS) must be considered for climate adaptation, or their exclusion must be actively justified, whenever land-use changes are foreseen. However, because these guidelines act as recommendations (sermons) rather than binding law (sticks), only a few municipalities

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interpreted them as true requirements, leading to poor compliance. Research indicates that it is only when these guidelines are integrated as strict "must" requirements within binding planning documents (e.g., such as municipal master plans) that urban planners are actually empowered to enforce NbS in localized zoning plans (Marino et al., 2025).

R2: **Translate binding urban restoration targets into context-sensitive spatial planning approaches/needs**

The recent adoption of the EU Nature Restoration Law (NRL) represents a pivotal shift as it translates BDS 2030's "sermons" into regulatory "sticks", establishing legally binding targets. For urban ecosystem restoration (Article 8), these targets include no net loss of urban green space and continuous increases in tree canopy cover, constituting an important first step linked to R1. However, operationalizing these top-down regulations poses significant challenges at the municipal level. First, enforcing strict quantitative compliance does not automatically equate to ecological success for biodiversity. Recent assessments of the NRL's urban targets reveal that while area-based requirements prevent baseline environmental degradation, actual biodiversity enhancement depends intricately on the spatial scale of implementation and specific ecosystem characteristics. Habitat quality (e.g., the preservation of core habitats and functional ecological connectivity) was found to be significantly more important for biodiversity than mere quantity or total canopy cover (Kinnunen et al., 2025). If the goal is to promote biodiversity, green infrastructure under NRL Article 8 must be intentionally designed and include habitat quality and connectivity requirements. Second, to make green infrastructure a viable planning tool to halt biodiversity loss and ensure its enhancement in consolidated urban fabrics (i.e., where at first glance there is no space available for nature), NRL targets must match context-specific spatial allocation needs. Planners should thus adequately choose among the different planning solutions that are emerging worldwide for redesigning and increasing greenery in consolidated urban spaces (as reviewed by Muñoz & Duarte, 2025), as well as privilege bottom-up approaches that promote meaningful stakeholder engagement, to account for the plurality of values that people place on urban green spaces and to co-design multifunctional solutions. As Pastore et al., (2026) highlight, the success of NRL Article 8 depends heavily on how seamlessly these binding urban restoration targets can be aligned with existing local planning instruments and greening plans, bridging the gap between European mandates and local spatial reality. Such alignment for biodiversity will likely require a "triple integration" approach (vertical, horizontal, and thematic) and multi-level governance arrangements (Bierwirth et al., 2024). In fact, recent evidence shows that important governance rearrangements and institutional innovations for integrating biodiversity goals into binding local planning instruments can be achieved through multi-level, collaborative planning processes (Falco et al., 2026). The scalability of such approaches depends on amplifying these successful cases through relevant networks.

ECONOMIC & FINANCIAL INSTRUMENTS

Insights from the interviews with financial and consultancy sectors highlighted a strong need to standardize metrics for biodiversity offsetting, mandatory disclosures, and voluntary guidelines and markets, which were discussed as essential policy instruments for addressing multiple BDS 2030 targets (e.g., 4, 17, 5, 9, 11, 10, 12). Actors revealed that businesses and financial institutions

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are currently struggling with a highly fragmented data landscape. While regulatory frameworks mandate disclosures related to biodiversity, the specific metrics used for these disclosures frequently do not align with the metrics used to price risk, comply with offsetting requirements or generate voluntary market credits. Finding common denominators to harmonize some of these metrics would also contribute to increasing the uptake of voluntary disclosures and voluntary nature credits by reducing the burden of additional data collection and assessments. Interviewed actors also highlighted that the inherent risk-aversion of private investors still hinders the successful implementation and scalability of economic and financial instruments for biodiversity. They signaled that de-risking private investments in biodiversity is needed, either by encouraging co-financing solutions or better showcasing empirical evidence of the additionality (ecological, social and financial) of such investments. Expanding on these topics with literature, we formulate two recommendations that can be addressed at the science-policy-society interface:

R3. Work towards standardized measurements and harmonized metrics for biodiversity among different finance-related instruments (reporting, offsetting and voluntary markets) while accommodating necessary flexibility

Marked-based instruments for biodiversity can take the form of like-for-like compliance-based compensation (e.g., biodiversity offsetting) or like-for-not-like voluntary commitments (e.g., nature/biodiversity credits) – with both theoretically supporting biodiversity enhancement (net gain) and being increasingly supported at the EU level (Holmlund et al., 2026; Maron et al., 2025). Both types require a unit of measurement to represent a biodiversity 'currency' or 'credit', which poses significant challenges.

Reviews of past biodiversity offsetting practices reveal that their ecological effectiveness has generally been poor, emphasizing that offsets must strictly adhere to the mitigation hierarchy to legitimately contribute to a nature-positive future (Maron et al., 2025). Specifically, offsetting measures implemented on a fragmented, project-by-project basis result in isolated outcomes that fail to deliver broader ecosystem resilience (Atkins et al., 2025). Instead, strategically locating offsets at a regional level to support broader conservation priorities delivers significantly higher biodiversity benefits (e.g., increased species richness) compared to merely placing offsets locally or as close as possible to the development site (Collins et al., 2025). To improve the biodiversity outcomes of offsetting measures, emerging research highlights the immense potential of aligning offset metrics with established, standardized reporting frameworks like the SEEA EA (the UN's System of Environmental-Economic Accounting—Ecosystem Accounting), which can consistently quantify biodiversity changes across different spatial scales. Czúcz et al. (2025) make a compelling case for how SEEA EA and offsetting metrics can be harmonized, while highlighting that there is still a need to explore and test meaningful reference levels and aggregation methods that can lead to contextualized biodiversity units. Advances in ecosystem valuation supported by expanding ecosystem services databases (like the ESVD) harmonized with SEEA EA (Brander et al., 2022) provide promising routes for estimating the financial value of these biodiversity units.

This also aligns with calls for standardization of biodiversity metrics in emerging voluntary nature markets (i.e., nature credits). Nature markets require fungible (perfectly interchangeable) units

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of biodiversity to ensure trade and lower transaction costs (measuring and monitoring). These nature credits must provide verifiable enhancements to biodiversity that would not otherwise occur (additionality), must not result in increased biodiversity loss elsewhere through displacement of activities (leakage) and are long-term (permanence) (Manez & Clifton, 2025). Recent literature demonstrates that attempting to translate complex biodiversity into fully fungible units inevitably strips away critical ecological nuances, leading to severe integrity risks and poor environmental outcomes (zu Ermgassen et al., 2026). Current nature credits are overly relying on habitat extent and/or condition metrics that are poorly correlated with critical components of biodiversity (e.g. invertebrate species richness) (Duffus et al., 2025; Marshall et al., 2024). To overcome these critical limitations and improve the integrity of the biodiversity units used in nature credits, policy frameworks must continue to work towards better, harmonized methods for both measuring and valuing biodiversity. Recent technological and scientific advances must be leveraged to this end. Kissling et al., (2026) make a compelling case for a EU-wide monitoring standardization system based on Essential Biodiversity Variables (EBVs). They establish a commensurable, multi-dimensional architecture that is able to capture nuanced changes across genetic diversity, species abundance, and ecosystem structure, which for instance could ensure rigorous tracking of the biophysical reality of biodiversity credits in nature markets.

Other finance-related instruments for biodiversity include reporting & regulatory frameworks (e.g. CSRD), which are often based on footprint estimates with double materiality (i.e., companies must report both on the impacts of their activities on people and the environment, as well as on how sustainability matters affect the their activities) (Mezzanotte, 2023). Corporate biodiversity footprinting tools often rely on the use of modeled pressure–state relationships (i.e., top-down intactness metrics) to estimate impacts across business value chains. These metrics are usually based on mean species abundance weighted by rarity according to IUCN red lists or on life-cycle assessment approaches that estimate potentially disappeared fraction of species and need to be complemented with bottom-up significance metrics such as species threat abatement and restoration (Burgess et al., 2024). For terrestrial biodiversity, Burgess et al. (2024) provide a detailed review of biodiversity-related metrics, indicators, indices, and layers, which address aspects of genetic diversity, species, and ecosystems. They conclude with a compelling case for a small number of metrics that should be covered to report on biodiversity (genes, species, ecosystems). Other authors have also explored this issue at the Member State level (e.g., in Germany, Grunewald et al., 2024), providing additional evidence of how ecosystem data and indicators can be used to identify national solution pathways for biodiversity finance, involving a wide range of actors at the science-policy-society interface. Understanding if and how reporting metrics can be further standardized and/or harmonized constitutes an additional step to strengthening the design and implementation of financial instruments for biodiversity. For instance, efforts are needed in supporting the interoperability of reporting frameworks (e.g., the joint work between TNFD and EFRAG) to ensure that scientific data provided by companies for "voluntary" reasons is high-quality and "regulatory-ready" for EU reporting.

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R4. Encourage small-scale pilot projects that can be responsibly scaled-up to de-risk private investments in biodiversity

The inherent risk-aversion of private investors remains a primary barrier to scaling financial instruments for nature (Flammer et al., 2024). Generating financial returns from biodiversity conservation (as opposed to biodiversity extraction or exploration) is theoretically feasible by bundling biodiversity with private goods whose value it directly enhances. In practical terms, financial returns may not be high enough and/or they might be considered too risky to attract private investors, often relying on "vague cashflow forecasts" with high financial uncertainty. As noted by Flammer et al. (2024): "(this) *higher ambiguity of biodiversity investment induces a need for "fact-finding" (e.g., running pilot programs or establishing proof of concept) that can be financed by concessionary capital in blended financing structures. In this setup, the higher the ambiguity the higher the attractiveness of blended finance".*

Additionally, despite the theoretical potential of biodiversity finance, showcasing reliable returns on investment in biodiversity at large scales has not yet been successfully achieved, partially due to the complex nature of the biodiversity concept and challenges to adequately assess it (Fenichel & Dean, 2024) - as addressed above in R3. Financial investors are growing concerned that attempting to scale these investments without proper evidence of their financial and socio-ecological benefits carries a significant danger of public and ecological backlash. For example, as seen in voluntary carbon markets (e.g., REDD+) poorly designed financial instruments have led to severe reputational damage, with companies being outed for greenwashing rather than delivering genuine, verifiable ecological gains (Morita & Matsumoto, 2023; Sasaki, 2025). This reinforces how biodiversity-related financial risk evaluation needs focus on local risks and impacts due to the local nature of biodiversity impacts and dependencies (Nedopil, 2023).

To safely navigate these risks, in addition to improving the biodiversity metrics used to account for additionality, leakage, and permeance of biodiversity (as addressed in R3), potential solutions should focus initially on small-scale pilot projects that can showcase positive, localized impacts on biodiversity (Flammer et al., 2024). To ensure true additionality, policymakers must watch out for the mere financialization of existing conservation funds, such as shifting private capital from traditional philanthropic initiatives directly into impact bonds or co-financing schemes. If philanthropic capital was already slated for nature conservation, repackaging these funds into complex financial instruments does not add new value; it merely creates costlier, more administratively heavy pathways to achieve the exact same biodiversity results (Thompson et al., 2023).

Finally, while private capital is necessary to bridge the funding gap for biodiversity conservation, market-based instruments must remain supplementary; they must not be used as an excuse to replace or dilute the fundamental, sovereign responsibility of governments in directly funding, regulating, and overseeing nature protection (Hackmann, 2024). In fact, there is long reported concerns on how for-profit conservation and financialization is framing biodiversity as an economic asset rather than an intrinsic ecological entity or public good (Svensson et al., 2025), For these reasons, small-scale pilot projects that foresee commensurable additionality (ecological, social, financial) can be encouraged to be scaled-up, for instance, through properly prospected blended finance mechanisms (reducing bureaucracy and facilitating access to co-financing solutions to a large pool of small players). As highlighted earlier in BOX 1, one avenue for securing small-scale projects with commensurable additionality for biodiversity that can be

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scaled-up through blended finance is by ensuring that R&I projects related to nature restoration and NbS actually anticipate in their proposals not only the physical implementation of the restoration measures and solutions but also potential co-financing options for implementation and monitoring involving the local private actors directly benefiting from its implementation, drawing from successful examples in Europe (e.g., Moniz et al., 2022).

SOCIAL & INFORMATION-BASED INSTRUMENTS

Interviews with consultancy actors, policy advisors, and regional NbS hubs have highlighted that current *social & information-based instruments* for biodiversity are hindered by two distinct, yet interconnected barriers, that touch across other policy approaches: fragmented information architectures and fragile institutional memory. The first issue is related mostly to a systemic "data silo" problem linked with regulatory frameworks such as the Corporate Sustainability Reporting Directive (CSRD). While CSRD is driving corporate action towards nature protection, it could be improved with access to information that is currently held by governments. The second issue relates to the need for capacity-building and knowledge creation efforts to stay in institutions beyond administrative cycles. It has been noted that biodiversity conservation efforts carried out regionally or locally are usually only properly managed for the duration of specific projects or of mandates of specific motivated actors who received training. As discussed in the interviews, both issues affect all BDS 2030 targets indirectly, though the second one was framed mostly under Target 3 and (protected area management) and Target 14 (urban greening plans). Expanding on these issues with literature, we formulate two recommendations that can be addressed at the science-policy-society interface:

R5. Facilitate transparent data sharing between public authorities (who hold licensing and asset location data) and the private/financial sector to improve biodiversity reporting and compliance.

Corporate disclosure regulations (e.g., the directive on corporate sustainability reporting, CSRD) function as vital *social and information-based* policy instruments that aim to halt biodiversity loss by establishing market transparency, exposing the previously hidden ecological impacts of business operations, and enabling stakeholder-driven governance (Grunewald et al., 2024). By mandating organizations to report on their interactions with nature – as further detailed in R3 - these frameworks shift accountability and empower civil society, investors, and consumers to drive socio-ecological transformations (Nelson et al., 2025). Recent empirical evidence confirms the demand for these reporting instruments, as investors and sustainability experts are increasingly engaging with sustainability disclosures just as they did with traditional financial reports (Hagemeier & Müller, 2026).

As such, despite its voluntary aspects regarding specific target-setting, disclosure regulations like the CSRD are currently the primary instrument motivating forward-looking companies to establish nature strategies, largely driven by stakeholder pressure and materiality assessments. However, under current CSRD reporting rules, companies only address biodiversity if they internally deem it "material" to their operations. Because the market is applying these complex materiality assessment criteria for the first time, there is significant uncertainty associated with it, which creates a dangerous room for businesses to use "sophisticated arguments" to evade

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the scope of the CSRD entirely. A major driver of this uncertainty is the unknown location of facilities in and along their supply chain. As recently evidenced by Nelson et al., (2025), spatial datasets are essential for reporting as "*without geographic context, organizations may overlook sensitive ecosystems, misjudge their level of exposure apply mitigation measures in the wrong locations, thereby undermining the credibility or effectiveness of their strategies*.

However, while governments often have access to such crucial spatial data via permits or other regulatory obligations (fiscal reports, access to public funding, etc.), financial institutions and corporate auditors do not possess this until it is officially reported. This information asymmetry makes real-time biodiversity risk assessment by independent consultants practically impossible. By working towards agreements for location disclosures, bridging these data silos and making public asset-location data interoperable with financial systems, regulators can close the materiality loopholes and ensure reporting criteria for biodiversity considerations are properly assessed. Avenues for bridging these data silos include, for instance, encouraging national biodiversity data infrastructures – as thoroughly reviewed and argued by Güntsch et al., (2025) - which should include mediators for legals questions (e.g., GDPR). Simultaneously, breaking down this data silos would encourage the deployment of localized decision support systems, which can translate complex biodiversity data into actionable, land-parcel-scale advice for local actors like farmers and land managers that operate along the supply chain, being particularly crucial for protecting rural areas exposed to degradation threats (Mileti et al., 2024).

R6. Institutionalize capacity-building and formalize cross-departmental collaboration within regional and local authorities to secure institutional memory and ensure the long-term sustainability of biodiversity interventions.

Recent literature highlights that local environmental progress is frequently driven by "conservation champions" or "policy entrepreneurs" (e.g., highly dedicated local officials who successfully push for biodiversity considerations within municipal planning) (Petersen et al., 2025). While these champions are vital for initiating innovative, localized projects for biodiversity protection or restoration, relying exclusively on their individual drive creates a severe structural vulnerability. When these individuals eventually leave their positions, or when political administrations change, the momentum is lost, and conservation progress is frequently stalled or reversed due to a critical loss of institutional memory and operational continuity (GEF Independent Evaluation Office, 2025). However, the successful implementation of biodiversity protection and restoration measures require long-term planning, implementation, and maintenance that extend far beyond standard four-to-five-year political election cycles or duration of R&I projects.

There are extensive claims to how capacity building for biodiversity governance should be improved, as reviewed by Sterling et al., (2022). But to establish the permanence of knowledge and ensure that innovative practices for biodiversity endure beyond capacity building initiatives – in other words, after 'champions' and trained individuals depart - capacity-building for biodiversity needs to be fundamentally improved to focus on institutionalizing structural changes in administrative practices rather than merely training individuals. This was particularly relevant for regional and local authorities implementing protection and restoration measures. This systemic approach ensures that successful conservation strategies do not depend solely on

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individual presence (and motivation) but become firmly embedded within the standard operations of the local authority. One successful pathway to achieve this is by ensuring that the co-design of nature restoration projects explicitly results in binding, cross-departmental agreements (as seen in Falco et al., 2026). For instance, actively involving multiple local actors and municipal departments in co-design processes for nature restoration projects could foresee formal *Memorandum of Understanding* among the various municipal offices involved, clearly delineating the long-term responsibilities regarding how the area will be jointly managed and monitored over time. Furthermore, by mandating that, EU-funded R&I projects facilitate these formal agreements into their deliverables, the collaborative networks and practical knowledge generated during temporary demonstration actions remain permanently embedded within the municipality's operational DNA long after the project funding ends.

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6. Key messages

- Social and information-based approaches are the most engaged with by the interviewed organizations for supporting the EU Biodiversity Strategy (BDS) 2030 targets, followed closely by legal & regulatory approaches.

- Economic & financial instruments for addressing BDS 2030 targets are also supported by many organizations interviewed, but we found no empirical evidence of its application to address specific BDS 2030 targets related to protected areas or urban greening.

- Rights-based and customary norms instruments for biodiversity conservation are still emerging, with limited but highly promising examples evidenced across stakeholder practices.

- Promising opportunities for improving and scaling legal & regulatory instruments for biodiversity include high engagement levels observed from local actors, new avenues for stakeholder collaboration, and improvements in technology and data collection at local scale.

- Harmonized approaches for biodiversity measurement and valuation are critical to ensure the ecological integrity of emerging financial instruments for biodiversity (like nature credits and biodiversity offsets).

- De-risking private investments through small-scale, localized restoration pilot projects and blended finance should be encouraged to responsibly scale financial instruments for biodiversity.

- The facilitation of transparent data sharing between public authorities and private/financial sector is key to improving biodiversity reporting and compliance.

- Capacity-building for addressing biodiversity issues through local planning should focus on securing institutional memory to ensure long-term management and monitoring of interventions.

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