D1.4 Guidelines and Future Pathways for biodiversity inclusion in spatial planning and policy

WP 1 Spatial Planning and Management Instruments (SP&MI)

Task 1.4 | D1.4 Capacity gap analysis to define future biodiversity pathways in spatial planning (M30)

Authors: Lia Laporta (University of Trento), Enzo Falco (University of Trento), Davide Geneletti (University of Trento)

Contributing authors: Ana Morais de Sá (University of Lisbon – Instituto Superior Técnico), Jorge Batista e Silva (University of Lisbon – Instituto Superior Técnico), Yuanzao Zhu (UFZ)

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Table of contents

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7. Annexes 63

List of Tables

List of Figures

Executive Summary

This deliverable presents the results of Task 1.4 of the BioValue project, which is the final task of WorkPackage 1 (WP1). The goal of this deliverable is to integrate results from previous tasks under WP1 and present the findings of an in-depth analysis into spatial planning and management instruments for biodiversity (SP&MIs).

Chapter 1 provides context and presents the final list of SP&MIs identified from the work developed under WP1 and which is the core object of all the subsequent work presented here. A total of 20 substantive SP&MIs with potential to protect, restore and enhance biodiversity in and through spatial planning have been identified and defined.

In Chapter 2, we provide a deeper understanding of the current capacity gaps for implementing these SP&MIs, by interacting with our Arenas for Transformation. We have developed an *ad-hoc* framework for determining potential capacity gaps and opportunities to overcome them. We evidenced that a key challenge in implementing SP&MIs is the significant capacity gaps in expertise, resources, and institutional coordination within municipal administrations, which are responsible for designing and implementing SP&MIs and often rely on external experts while facing limited funding. Additionally, vested interests from sectors such as urban development, agriculture, and infrastructure often prioritize short-term economic gains over long-term ecological benefits, hindering the integration of biodiversity goals into spatial planning processes. Overcoming these gaps requires investing in internal capacity, strengthening legal frameworks, enhancing meaningful stakeholder engagement, and addressing vested interests through collaboration, incentives, and strategic planning.

Next, in Chapter 3 we explore how SP&MIs can support protecting, restoring and enhancing biodiversity on the ground. To this end, we perform a contribution analysis focusing on the different instruments, individually and in combination, and how they support three basic biological principles: habitat quality, area of habitat, and connectivity. We also expand our analysis to go beyond objective 6 of the EU Taxonomy Regulation (i.e., to Protect and Restore Biodiversity), given the interrelation of biodiversity with other climate and environmental objectives, by including other objectives such as climate change mitigation and adaptation, water resources, pollution prevention and control, and circular economy. Our results indicate that most of the SP&MIs are only directly contributing to an increase in area of habitat, while conditionally contributing to habitat quality and connectivity. To support habitat quality, most SP&MIs need to be used in combination with biodiversity assessment and monitoring, guidelines and recommendations for development, or specific qualitative requirements. To support habitat connectivity, SP&MIs need to be implemented under strategic planning and/or coupled with condition assessments to help either target or prioritize areas for intervention. Finally, we show that all of the SP&MIs can contribute to other environmental and climate objectives depending on their design and implementation, and we highlight significant evidence of particular contributions to climate change and water resources from the examples analyzed in WP1.

Lastly, we assessed the transformative change potential of SP&MIs for biodiversity in Chapter 4 by identifying the main challenges and opportunities for addressing the three ambitions for transformative change defined in BioValue (D4.3) through SP&MIs for biodiversity. Our results show that most SP&MI have a potential to positively contribute to address the ambitions, particularly if combined with other instruments, but this contribution is conditional to design, implementation, and post-implementation management. We see that the combination of well-designed SP&MIs, strategic integration, and inclusive processes strengthens the transformative potential of SP&MIs for biodiversity.

To conclude, we summarize the findings of this deliverable in a set of recommendations in Chapter 5, which displays potential pathways for valuing and enhancing biodiversity in and through a more transformative spatial planning practice, focusing on the set of substantive SP&MIs analyzed. In line with the instrumental perspective that is at the foundation of the BioValue project, we also advance how each SP&MI could be supported by other instruments (namely environmental assessment and economic & financial instruments). These interactions will now be the subject of further research under the project.

1. Spatial Planning & Management Instruments (SP&MI) for biodiversity: a comprehensive list of substantive tools

1.1. Brief context

The BioValue project explores instrumental perspectives in biodiversity enhancement by integrating three key areas: spatial planning, environmental assessment, and economic/financial incentives. This approach emphasizes transformative change in policies and practices, aiming to protect and enhance biodiversity while promoting societal and economic benefits. Each key area is the subject of a specific WorkPackage (WP), and WP1 has focused on spatial planning and management instruments and the transformative potential of spatial planning decision-making processes to safeguard and enhance biodiversity. A generic spatial planning process has been developed in the project (Figure 1). The structured approach depicted in this generic process is designed to reflect the need for collaborative governance, active engagement, and co-creation across various sectors, scales, governance levels, and stakeholders. The looping sequence indicated by the central arrows represents the expected dynamic, iterative process that ensures planning remains systematic, inclusive, and adaptable to evolving conditions and new insights.

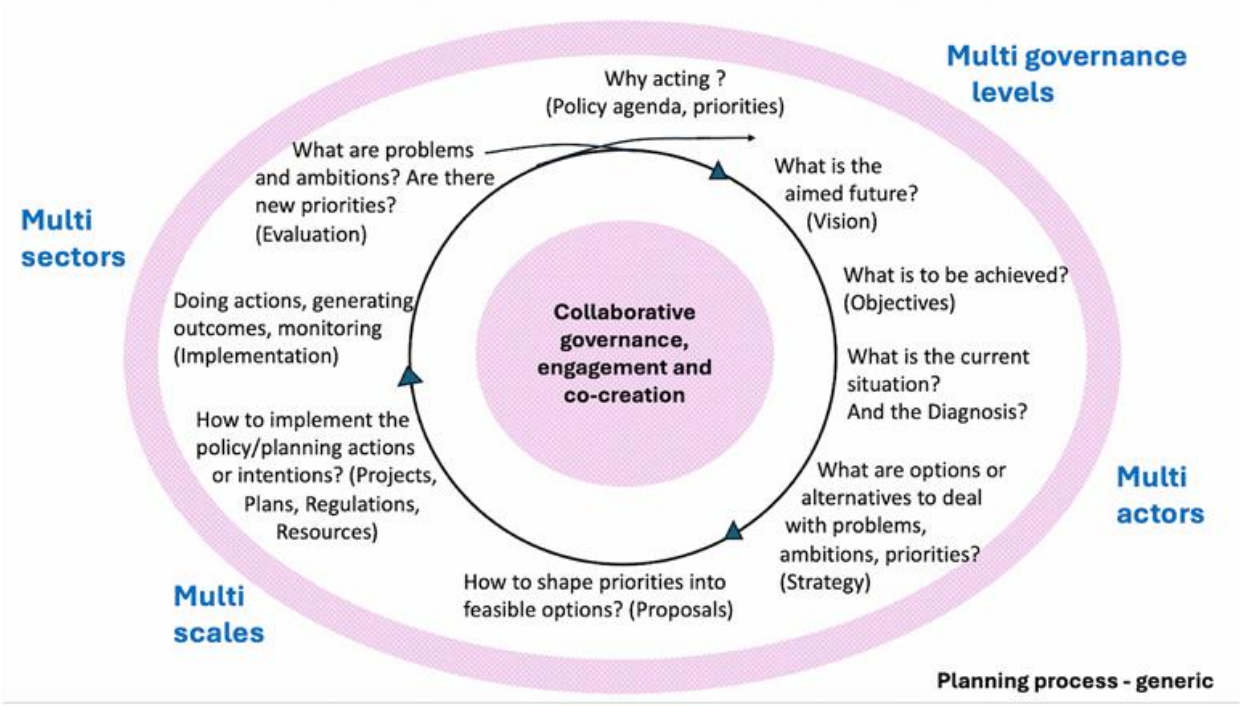

Figure 1 The cyclic spatial planning process as represented in BioValue (Partidario, 2024).

Various policy instruments can both support or be embedded in such planning processes to ensure its implementation. In the realm of spatial planning policy, we draw focus to two types of instruments as defined by (Stead, 2021): **procedural instruments** and **substantive instruments**. Substantive instruments refer to those that directly **affect the delivery of policy goals** while procedural instruments refer to those that **affect the process and procedures of developing policy** (e.g., how policies are formulated, implemented, and evaluated by government actors and agents).

These two types of instruments are closely interlinked: procedural instruments support the functioning of substantive instruments, whereas substantive instruments operationalize procedural instruments. In spatial planning, procedural

instruments refer, for example, to spatial plans, programs or policies (designed at various scales) while substantive instruments refer to the actual regulations and actions implemented under such plans, programmes and policies.

In Deliverable 1.1 (Orta-Ortiz et al., 2023) we have explored the transformative potential of **procedural spatial planning instruments**, by analyzing a set of spatial plans and programs from different EU countries at different scales, to understand the transformative potential of the planning process for biodiversity. In Deliverable 1.2 (Batista e Silva et al., 2024), we have also analyzed both procedural and substantive instruments from identified best-practice initiatives, plans and projects, to better understand how biodiversity is being integrated. In Deliverable 1.3 (Laporta et al., 2023), we advanced a framework for assessing ecosystem services (ES) in transformative spatial planning practice, focusing particularly on how these assessments can support the generic planning process depicted in Figure 1.

In the present deliverable, we focus specifically on **substantive spatial planning instruments**, in order to understand how their implementation can support the achievement of the visions and goals for biodiversity protection and enhancement that are defined in the planning process. Hereinafter, these substantive instruments will be referred to as Spatial Planning and Management Instruments (SP&MIs) for biodiversity. These instruments can be implemented throughout the spatial planning process cycle represented in Figure 1, to operationalize the spatial plan, program or policy (i.e., the procedural instrument) to which the process belongs.

The list of SP&MIs provided here has been derived mainly from recent studies (Longato et al., 2024; Trinomics & IUCN, 2019; Kamiya & Zhang, 2017) and expanded based on the work carried out under Task 1.1 (e.g., the concrete actions and regulations evidenced in the different plans and programs analyzed), under Task 1.2 (e.g., examples of substantive planning instruments found in the best-practice initiatives analyzed), and under Task 1.3/4.2 (e.g., examples of evidenced implementation of a few substantive instruments through the Arenas for Transformation).

1.2. List of SP&MIs for biodiversity

A set of 22 substantive spatial planning instruments for biodiversity have been defined and analyzed in this deliverable (Table 1). An extended version of Table 1 is provided in Annex A, illustrating relevant examples of the application of each instrument derived from the work carried out in previous tasks in WP1 (and from the literature).

Inspired by a recent review of spatial planning tools (Stead, 2021), we have grouped these instruments under 5 main categories based on its dominant intended form of application – i.e., if they are mainly applied through (1) enforcement, (2) regulation, (3) case-specific projects or actions, (4) information-based actions, or (5) incentives. The categories listed are in Table 1 (and in subsequent chapters of this deliverable) from more restrictive/binding (e.g., Enforcement and Regulations) to more steering/voluntary instruments (e.g., Information and Incentives).

Table 1 List of SP&MIs for biodiversity analyzed in Task 1.4. Expanded from Longato et al (2024), Trinomcs & IUCN (2019) and Kamiya & Zhang (2017), based on the work developed under WP1.

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION
ENFORCEMENT INSTRUMENTS	**Expropriation of land (including compulsory conservation easements)**	Expropriation is the government's ultimate legal tool for acquiring private land for public interest uses (urban development, infrastructure, and public utilities), often following the formal declaration of public interest, with compensation provided to the landowner.
	Administrative Possession	Administrative possession is a legal tool that enables the administration to take possession temporarily to do what the owner should have done and did not do. The return is then made with charges.
	Preemption rights	The right of preference exerted by public entities which allows the administration to override a deal between individuals in order to acquire a given good for the same value.

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION
REGULATORY INSTRUMENTS	**Quantitative targets or standards**	Definition of quantitative targets or standards that must be met when developing or redeveloping an area. This includes developer's obligations such as dedication requirements to set aside a portion (%) of land for specific public purposes (typically local public facilities or infrastructure in urban contexts). Can be implemented with equalization of benefits & burdens.
	Qualitative and Technological Requirements	Definition of qualitative elements or technologies that must be included when developing or redeveloping an area. This includes developer's obligations such as mandatory green roofs, and can be implemented with equalization of benefits & burdens.
	Compensation measures	Definition of mandatory ecological compensation actions that must be realized when developing or redeveloping an area.
	Performance-based approaches with point systems	Definition of a minimum performance score that must be gained by attaining defined levels of green and blue surfaces when developing or redeveloping an area.
	Conservation zones, greenbelts, or protected areas and sites	Identification of specific sites or green elements to be preserved and definition of restrictions to their use and transformation, usually under existing and binding regulatory frameworks for development or under ad-hoc regulatory framework
	Land parcel ownership rearrangements	Land parcel ownership rearrangements involve a planned readjustment of land parcel boundaries, sizes, or ownership. These processes aim to improve land use efficiency, align with broader spatial and environmental policies, and ensure an equitable distribution of the benefits and burdens resulting from spatial and environmental policies between landowners and the community (such as those associated with biodiversity promotion). In urban and peri-urban contexts, land readjustment is predominantly applied, whereas land consolidation is used in rural areas. These readjustments can involve voluntary agreements between private landowners, though they are often instigated or enforced by the government. Key mechanisms include voluntary land swaps (ensuring fair compensation and treatment between landowners), land dedication requirements, economic and financial compensations, and expropriation. Can be implemented with equalization of benefits & burdens for adequate equity and compensation.
	Land use zoning schemes in urban or rural spaces at different scales	Land use zoning schemes in urban or rural spaces at different scales. Includes the definition of permitted and forbidden uses/management activities related to specific land uses. Widely used land use plans for cities, municipalities or rural areas, typically ranging from 1/10.000 to 1/100.000 geographic scales, often have significant impacts on the organization of different land uses and major infrastructures on the territory.
	Other instruments related to zoning regulations	Other instruments related to zoning regulations
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**	Definition of specific design solutions and regulations to apply to a specific development area, which are formalized in a (master)plan that identifies the approximate location, typology, and size of the main elements over the entire project. They can be part of execution or implementation programs.
	Land acquisition	The public administration (e.g., municipality) buys the land from the owners to prevent development or to realize specific public (green) projects (also called “fee simple” acquisition programs).
	Contractualizations, Partnerships and Stewardships, including voluntary conservation easements	Widely used tools where the (local) administration can assume different roles (regulator, coordinator/ leadership, imposition) in the contractualization of territorial development for specific purposes. This can include contractual partnerships between public institutions, between private and public institutions, as well as stewardship/sponsorship agreements for the maintenance or development of specific areas. It also includes legal agreements placed on a piece of property to restrict the development, management, or use of the land, known as Conservation Easements, which involves the voluntary selling or gifting of one or more of

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION
		rights (e.g., occupy, use, lease, sell, and develop the land, as well as harvest the vegetation and minerals on it) from the land owner to a public agency or organization, for a specific (conservation) purpose
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	Increase in the floor area/building volume allowed in the site in exchange for meeting certain criteria.
	Transfer of development rights (TDR) mechanisms	Giving rights to build in another area or to sell the development rights in exchange for the preservation from development (through a conservation easement) of the original area. Can be implemented with equalization of benefits & burdens to free-up space for biodiversity, functioning like a compensation scheme.
	Fast-tracking approval process	Fast-tracking of approvals (or expedited/agile permitting processes) for projects that incorporate greening interventions, ideally associated with its respective management plan.
	Interim use permits (abandoned/vacant lots)	Temporary activation of vacant and/or underutilized land for a defined period of time, under specific terms defined within a temporary use permit issued by local authorities. Here only permits for garden/urban agricultural purposes or for recreational uses with blue/green infrastructures are considered.
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**	Guidance documents providing design guidelines and/or criteria that should be applied when realizing and/or managing public spaces. This includes provisions from higher planning levels and other sectors.
	Guidelines for promoting good practices in private spaces	Guidance documents and manuals providing information on (nature-based) principles, best practices, and techniques to apply in private areas.
	Biodiversity monitoring & Ecosystems Services Assessments	Biodiversity databases, indexes and indicators, including monitoring systems and assessment of ecosystem condition and Ecosystem Services.
	Other information-based instruments	Other instruments aimed at supporting biodiversity enhancement/protection and green space planning activities by providing relevant information and knowledge, including monitoring tools
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	Increase in the floor area/building volume allowed in the site in exchange for meeting certain criteria.
	Transfer of development rights (TDR) mechanisms	Giving rights to build in another area or to sell the development rights in exchange for the preservation from development (through a conservation easement) of the original area. Can be implemented with equalization of benefits & burdens to free-up space for biodiversity, functioning like a compensation scheme.
	Fast-tracking approval process	Fast-tracking of approvals (or expedited/agile permitting processes) for projects that incorporate greening interventions, ideally associated with its respective management plan.
	Interim use permits (abandoned/vacant lots)	Temporary activation of vacant and/or underutilized land for a defined period of time, under specific terms defined within a temporary use permit issued by local authorities. Here only permits for garden/urban agricultural purposes or for recreational uses with blue/green infrastructures are considered.

2. Capacity Gaps for the Implementation of SP&MI for biodiversity

2.1. Introduction

Focusing on the set of substantive spatial planning instruments for biodiversity listed in the previous chapter, we have explored current capacity gaps for their implementation by designing a framework based on the outcomes of two recent European projects. We began by conducting a review of published literature to identify existing frameworks or methodologies that explore the capacity of planners and decision-makers to implement spatial planning instruments, particularly for biodiversity or other environmental goals. Among the reviewed sources, the IN-PLAN European Project (LIFE Programme-funded) was identified as particularly relevant (section 2.1.1). Their framework, tested with municipalities across several European countries, provided a foundational structure applicable to the context of local and regional spatial planning in Europe, though they focused on planning instruments for climate adaptation/mitigation and energy transitions. To tailor the IN-PLAN framework specifically for biodiversity, we incorporated insights from the on-going BioAgora project (EU Horizon Programme-funded) (section2.1.2), which is advancing a Science Service for Biodiversity and has produced useful knowledge on current capacity needs at the science-policy-society interface for addressing biodiversity challenges. By integrating these complementary approaches, we developed a novel framework that addresses the unique capacity needs of spatial planning instruments in relation to biodiversity. This iterative approach ensures that our framework is both grounded in practical applications and aligned with emerging scientific and policy priorities for biodiversity conservation.

Our framework consists of 16 potential design and implementation gaps related to the capacity of practitioners and decision-makers (presented in section 2.2). We framed these gaps into a set of questions that were applied to each Arena, in order to understand the individual and collective challenges and opportunities they faced in the design and/or implementation of the SPM&Is they have explored under BioValue. Practitioners have contributed by answering these questions in writing, and elaborating on specific elements in each question, as per the instructions provided (Annex D). Follow-up interactions were made whenever necessary. Through our methodological approach, the in-depth analysis presented here was limited by the few SP&MIs for biodiversity that are being actually designed, implemented or explored under BioValue.

2.1.1. Capacity gaps for implementing spatial planning instruments in the context of environmental objectives

In order to understand the challenges of designing and implementing SP&MIs for biodiversity, we first refer to reported evidence from planners and decision-makers regarding the most common challenges and barriers to the implementation of procedural and substantive spatial planning instruments with environmental goals. Researchers from the recent EU LIFE IN-PLAN project have conducted a three-fold analysis (with online surveys, workshops, and analysis of projects and the literature), working closely with local municipalities covering seven EU countries (Croatia, Italy, Romania, Sweden, Ireland, Greece, and Belgium), to discuss current local-specific spatial planning practices, needs, gaps and barriers, as well as possible solutions for better integrating environmental aspects (more specifically climate and energy-related) in spatial planning (Forstinger et al., 2023). Their work resulted in a set of capacity gaps grouped into five typologies, as shown in Annex B

2.1.2. Capacity needs for addressing biodiversity at the Science-Policy-Society interface

To re-focus the IN-PLAN framework from climate/energy related issues to biodiversity, we analyzed the broad range of challenges for addressing biodiversity issues at the science-policy-society interface, and respective capacity needs to address them, that have been recently highlighted by the BioAgora Project (European Commission Horizon Europe Programme No. 101059438), specifically in deliverable 5.1 (Czett et al., 2024). The work developed in BioAgora was framed by a literature review, desk research and analysis of prior project interviews to conceptualize capacity needs, to map capacity development initiatives and to identify key stakeholders to engage with for data collection. Data

collection included *ad-hoc* stakeholder interviews that provided qualitative insights and a researcher survey that offered quantitative data on capacity gaps. Using qualitative-narrative analysis and descriptive statistics, they categorized 290 capacity-related entries into individual skills, organizational capacities, and contextual factors, highlighting patterns across stakeholder groups and thematic areas. It resulted in the identification of 18 themes of current capacity needs to address biodiversity challenges, listed and briefly defined in Annex C.

2.2. Reported capacity gaps for implementing SP&MIs for biodiversity

In the work presented in the present deliverable, we have developed a specific framework to assess capacity gaps for the design and implementation of SP&MIs for biodiversity. Our framework consists of 5 category of capacity gaps that refer to 16 topics identified and defined specifically for SP&MIs for biodiversity (fully detailed in Annex D). The topics were defined as follows (Table 2) based on the frameworks from the projects presented above.

Table 2 Framework to assess capacity gaps for designing and implementing SP&MIs for biodiversity. Based on work from Czett et al. (2024) and Forstinger et al. (2023).

GAP CATEGORY	IDENTIFIED GAP	DEFINITION	*from IN-PLAN*	*from BioAgora*
PERSONNEL & FINANCIAL RESOURCES	**Qualifications & Know-How**	Lack of (qualified) personnel within local administrations responsible for spatial planning with capacity to properly address biodiversity issues.	*Lack of qualified personnel in local administrations for planning energy and climate aspects.*	*Institutional capacity-building; need for specialized skills in science-policy interfaces for biodiversity.*
	Time Management	Policymakers often have limited working time to deepen the knowledge necessary for designing and implementing planning instruments for biodiversity.	*Time constraints from institutional rigidity and prioritization issues.*	*Emphasis on policymakers' limited time for deepening knowledge and collaboration with science.*
	Funding	Limited financial resources for stakeholders in the design and implementation of biodiversity planning instruments, affecting participation and adequacy.	*Financial resource limitations for participatory processes and external expertise in energy and climate planning.*	*Highlighted funding gaps as a barrier to collaboration and effective biodiversity planning.*
KNOWLEDGE & EXPERTISE	**Data Availability**	Missing or insufficient local-specific data hinders spatial planning decisions for biodiversity.	*Gaps in access to local energy and climate-specific data for spatial planning.*	*Need for evidence-based local information; bridging data gaps to inform biodiversity-related decisions.*
	Complex Topic	Complexity of scientific knowledge makes it challenging to tailor for decision-making in biodiversity planning.	*Complexity of energy and climate-related scientific knowledge can hinder planning decisions.*	*Tailoring complex knowledge for practical decision-making in biodiversity contexts.*
	Need for Mediators	Need for third-party mediators to facilitate communication between science and policy in biodiversity planning.	-	*Role of intermediaries in facilitating communication and supporting decision-making.*
LEGISLATIVE FRAMEWORK	**Supportive Legal Framework**	Absence of mandatory legal requirements for biodiversity in spatial planning; reliance on voluntary initiatives limits integration efforts.	*Absence of mandatory legal requirements for energy and climate in spatial planning.*	
	Legal Complexity	Complex legal hierarchies cause inconsistencies in planning instruments for biodiversity.	*Complex legal hierarchies lead to inconsistencies in planning instruments for energy and climate.*	

GAP CATEGORY	IDENTIFIED GAP	DEFINITION	*from IN-PLAN*	*from BioAgora*
GOVERNANCE & PROCESSES	**Institutional Support**	Lack of reward structures, poor horizontal cooperation, and high bureaucracy hinder biodiversity planning participation.	*Challenges like bureaucracy, lack of reward structures, and poor horizontal collaboration in energy and climate. Lack of political will and/or support.*	*Institutional and structural barriers to science-policy collaboration in biodiversity planning.*
	Harmonized Timelines	Misalignment between policy cycles and scientific research timelines affects biodiversity planning design and implementation.		*Inflexibility of policy cycles; time requirements of scientific processes not accommodated in biodiversity planning.*
	Clashing Views	Resistance from differing mindsets and attitudes among decision-makers hampers biodiversity planning.	*Resistance from differing mindsets and attitudes among decision-makers in energy and climate.*	*Difficulty in achieving consensus due to conflicting worldviews on biodiversity priorities.*
	Silo-Thinking & Working	Fragmented approaches in planning authorities limit collaboration and integration in biodiversity decision-making.	*Fragmented approaches hinder cross-sectoral collaboration in energy and climate.*	*Need for integrated decision-making; overcoming sectoral divides in biodiversity policy design.*
	Monitoring	Implementation of spatial plan requirements is often not continuously evaluated, affecting biodiversity outcomes.	*Lack of follow-up on energy and climate-focused spatial plans to ensure their implementation and effectiveness.*	*Emphasis on monitoring biodiversity outcomes and adapting plans based on results.*
AWARENESS & POLITICAL WILL	**Nature Seen as a Burden**	The perception of biodiversity conservation as a cost further complicates implementation of planning instruments.		*Addressing societal and stakeholder biases that view nature conservation as a burden.*
	Stakeholder Engagement	Narrow engagement with stakeholders limits understanding of problems in biodiversity planning.	*Narrow range of stakeholders limits understanding of energy and climate issues.*	*Need for inclusive, participatory approaches that involve diverse groups in biodiversity planning.*
	Vested Interests	Private interests and lobbying limit the effectiveness of biodiversity planning and favor private goals over societal ones.	*A lack of a unanimous opinion on the political level on how to move forward on certain issues creates the risk that spatial plans lack in ambition or are watered down due to compromises.*	*Influence of power dynamics and resistance from entrenched interests in biodiversity-related policy-making.*

The framework developed was then applied to the Arenas for Transformation (Annex D). As such, it was only possible to focus on the instruments Arenas have conceived, implemented or explored under the BioValue project. With this approach, we have assessed capacity gaps for the design and/or implementation of 8 substantive spatial planning instruments for biodiversity, namely four regulatory instruments (*Land use zoning schemes in urban or rural spaces at different scales*, *Qualitative or Technological Requirements, Conservation zones, greenbelts, or protected areas and sites*, and *Land parcel ownership rearrangements*), two action-based instruments (*Design-based instruments* and *Land acquisition*), and two information-based instruments (*Biodiversity monitoring & Ecosystems Services Assessments* and *Guidelines for promoting good practices in private spaces*). We summarize our findings below (Table 3), and briefly discuss the results per instrument in the following subsections. The full analysis is presented in Annex E.

Table 3 Summary of reported capacity gaps for the design and/or implementation of SP&MIs for biodiversity. Full analysis in Annex E.

Red cells show gaps which have hindered the design or implementation of the instrument.
Pink cells indicate gaps that were addressed and/or successfully overcome.
Grey cells indicate no gap or not enough information to discuss the gap (N/A).

SP&MIs		IDENTIFIED CAPACITY GAPS															
		PERSONNEL & FINANCIAL RESOURCES			KNOWLEDGE & EXPERTISE			LEGISLATIVE FRAMEWORK		GOVERNANCE & PROCESSES					AWARENESS & POLITICAL WILL		
		QUALIFICATIONS & KNOW-HOW	TIME MANAGEMENT	FUNDING	DATA	COMPLEX TOPIC	NEED FOR MEDIATORS	SUPPORTIVE LEGAL FRAMEWORK	LEGAL COMPLEXITY	INSTITUTIONAL SUPPORT	HARMONIZED TIMELINES	CLASHING VIEWS	SILO-THINKING & WORKING	MONITORING	NATURE SEEN AS A BURDEN	STAKEHOLDER ENGAGEMENT	VESTED INTERESTS
REGULATORY INSTRUMENTS	Qualitative and Technological Requirements																
	Land parcel ownership rearrangements																
	Conservation zones, greenbelts, or protected areas and sites																
	Land use zoning schemes in urban or rural spaces at different scales																
ACTION-BASED INSTRUMENTS	Design-based instruments																
	Land acquisition																
INFORMATION-BASED INSTRUMENTS	Guidelines for promoting good practices in private spaces																
	Biodiversity monitoring & Ecosystems Services Assessments																

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2.2.1. Regulatory Instruments

Qualitative or Technological Requirements

The challenges identified for this instrument stem from the interactions with practitioners from the Mafra Arena (Portugal) focusing particularly on the adoption of a new regulatory instrument mandating green roofs in new developments or redevelopments within the city. A significant reported gap lies in the **lack of expertise and qualifications** within the administrative division, which hampers the modification of municipal building and planning regulations necessary for implementing the instrument. This technical gap underscores the need for specialized knowledge to ensure that green roofs are integrated appropriately into urban planning, which is currently unavailable. Additionally, there is a critical need for **supportive and adaptive legal frameworks** at the national level, as the existing legislative context does not adequately accommodate such innovative building requirements. This legal complexity necessitates targeted training for staff to navigate and align the instrument with the current legal system. According to the municipality, some degree of political disinterest emerges as a recurring obstacle in this type of technological requirements, with limited prioritization of biodiversity-oriented objectives, insufficient time management, and restricted efforts to integrate different planning strategies. These factors reflect broader institutional and cultural barriers, such as siloed administrative structures and vested political interests, which collectively hinder progress in advancing substantive technological requirements for biodiversity such as this one. As the instrument has not been implemented or designed, but merely explored under BioValue, there were no opportunities for trying to overcome some of these gaps. Also, there was limited information to discuss about governance and awareness gaps (mostly marked grey in the table).

Land parcel ownership rearrangements

The key challenges identified for this instrument, as explained by the Mecklenburg-Vorpommern Arena, result from interactions with the local/regional administration and liaisons concerning the Nature Reserve of Mecklenburg-Vorpommern (these interactions will be detailed in another upcoming project deliverable from WP4). The goal of designing and implementing this instrument in the region is to support rewetting of peatlands that have been drained and maintained for agriculture for over 60 years. Rewetting is being strategically considered to address climate change mitigation targets, but it can also benefit biodiversity in the process. This instrument in particular would allow focusing rewetting on specific areas, ideally with higher ecological interest, where land-owners would be willing to engage in the process. A major reported issue to implement this instrument is the severe **shortage of qualified personnel** within regional spatial planning offices, exacerbated by the rural location and difficulty in attracting skilled staff. This personnel gap, combined with a **lack of funding**, particularly for compensating landowners, limits the ability to implement land rearrangements for rewetting. Moreover, there is a significant **data gap**, as insufficient resources hinder the ability to model future water levels and identify which parcels will be affected by rewetting, making it difficult to plan effectively. The **complexity** of the rewetting process itself—due to the large land areas involved and the unpredictable nature of water levels—further complicates planning efforts. This complexity is intensified by the **land ownership situation**, as private landowners are only willing to participate voluntarily, and cannot be forced to change land use, making it challenging to reach agreements.-**Institutional support** for this process is also lacking, with low awareness about how land rearrangements can contribute to rewetting efforts. Landowners' reluctance to exchange productive land for less valuable land creates a significant barrier, as their **vested interests in maintaining agricultural land outweigh the incentives for environmental restoration**. These challenges underline the need for more comprehensive coordination, stronger financial support and better engagement with landowners and other stakeholders to ensure the success of land parcel ownership rearrangements for biodiversity and climate mitigation goals. As the instrument has not been implemented or designed, but merely explored under BioValue, there were no opportunities for trying to overcome some of these gaps. Also, there was limited information to discuss about governance and awareness gaps (mostly marked grey in the table).

Land use zoning schemes in urban or rural spaces at different scales

This instrument has been investigated in Mafra Arena, concerning specifically the on-going process of the second revision of the Municipal Master Plan and how *zoning schemes and land-use reclassification* could better support biodiversity. One of the main issues reported is the **lack of coordination** between different divisions within the municipality, which hampers the integration of biodiversity considerations into the zoning process. While there is strong political support for biodiversity in this municipality, this is not always translated into practical action, particularly due to the **complex legal and technical requirements** for updating the Master Plan and aligning it with the national ecological network - REN. A significant barrier to effective biodiversity integration is the **lack of adequate resources**, both in terms of qualified personnel and funding, which limits practitioners' ability to gather and analyze necessary data for informed decision-making. Under the BioValue project, this gap has been partially addressed with collaborations with the scientific partners that provided advise and data to be included in the design of zoning schemes. Additionally, there is a **strong bias towards urban development** in public discussions, with biodiversity often seen as a secondary concern compared to economic growth. This creates a difficult situation for planners, who must navigate **conflicting interests** while ensuring that environmental considerations are not sidelined. Lastly, the **siloed nature** of municipal departments means that there is insufficient cross-departmental collaboration, further complicating the integration of biodiversity into zoning and land-use plans. These challenges reflect the tension between development "imperatives" and sustainable land management within the municipality's zoning processes.

Conservation zones, greenbelts, or protected areas and sites

The key challenges identified in the implementation *of Conservation Zones, Greenbelts, or Protected Areas and Sites* were derived in the context of the revision of the Rede Ecológica Nacional (REN - - National Ecological Network) in Mafra Municipality, Portugal, as part of the second revision of their Municipal Master Plan. The gaps identified are multifaceted. A major challenge lies in the **lack of technical expertise and specialized knowledge** needed to revise and apply this instrument effectively. While scientific partnerships are considered essential, the municipality faces **difficulties in ensuring adequate access to relevant data and expertise** for properly integrating biodiversity concerns into spatial planning. Although the existing legal frameworks, such as REN, provide some structure for conservation, they are seen as **insufficient for directly addressing biodiversity issues**, which limits their practical effectiveness. There is a recognized need for a **stronger legal and institutional framework** that explicitly incorporates biodiversity protection. Internally, the institutional support for biodiversity integration is positive, especially from the political leadership and spatial planning divisions, yet the **lack of collaboration between municipal divisions** presents a significant barrier. This siloed approach creates fragmentation in the planning process, making it harder to ensure that biodiversity concerns are effectively incorporated at every stage of the revision of REN. While there is political support for integrating biodiversity into planning, limited engagement with external stakeholders and broader societal interests restrict the depth of the conversation around conservation zones and protected areas – e.g., what should be protected and how. Though the revision of this instrument is still in progress in Mafra, through the work performed under BioValue it was possible to identify how some of these gaps could be overcome, including the need to foster **better inter-departmental cooperation**, **improve data access**, and **advocate for stronger legal measures** that more directly address biodiversity conservation. The successful implementation of this instrument depends on overcoming these barriers and ensuring a more integrated and well-supported planning process that genuinely reflects the municipality's biodiversity priorities.

2.2.2. Project or Action-based Instruments

Design-based instruments

The design-based instrument analyzed refers to the requalification projects along the Fersina River, in the municipality of Trento. By interacting with the municipality, we evidenced a series of interconnected challenges. One of the most significant issues is the **lack of full-time personnel** dedicated to the requalification project, which was only possible with the support of BioValue. While the principles of design-based instruments (e.g., the nature-based solutions being designed) are not inherently complex, the **data requirements** and the need for scientific support to ensure the

ecological success of the requalification were main challenges to be addressed. In this sense, there was a **need for mediation** between scientific and municipal actors, with external experts stepping in to fill the knowledge gaps. There was reported **legal complexity** of aligning the project with various regional and national requirements, particularly in relation to the Provincial Urban Plan and the fluvial ecological extension of protected areas. The project is constrained by the **bureaucratic layers** inherent in coordinating across different levels of government, which sometimes delays decision-making and complicates implementation. This is coupled with the challenge of navigating **mixed reception** from stakeholders. While local provincial institutions were supportive, the national government's resistance to certain land use decisions, such as those related to the Defence Ministry's land for housing close to Fersina/Adige junction, underscores the **difficulties of reconciling competing development interests** with biodiversity goals. Another reported challenge is the **clashing views** on biodiversity, particularly in relation to the maintenance of vegetation along the river. Some stakeholders, especially those responsible for vegetation management, view biodiversity enhancements as potential safety risks. Finally, while the project has seen significant **stakeholder engagement** from local entities, which was possible with the support of BioValue, the presence of **private interests** and **political opposition** to certain land uses has created barriers to fully realizing the potential of the design-based instrument for biodiversity. Despite these challenges, the municipality's commitment to the project and the strong network of local stakeholders offers a solid foundation for further progress, though more resources and coordination are needed for long-term success.

Land acquisition

The land acquisition instrument for biodiversity conservation has been explored in Mafra Arena and several challenges to its implementation were reported, related mostly to expertise, funding, and legal frameworks. While there has been some limited success with acquiring land (such as a specific 16-hectare site for ecological restoration), the municipality faces significant **gaps in specialized knowledge**, especially in ecological restoration and biodiversity-related projects. This lack of internal expertise makes it difficult to develop and implement restoration plans for biodiversity effectively. Funding also remains a major obstacle, with biodiversity-focused land acquisition projects often competing with other municipal priorities, such as urban infrastructure development. While there is a general **legal framework** for ecological restoration, it is not well-suited for biodiversity conservation, and there is a need for more targeted guidance and training to integrate these concerns into land acquisition processes. Additionally, the **bureaucratic and institutional complexities** further complicate the process. There is a **lack of coordination between municipal departments**, with departments focused on urban infrastructure often unable to adjust to non-building-related projects like biodiversity restoration. Furthermore, private landowners control land pricing, making negotiations difficult and leading to delays in land acquisition. The **slow acquisition bureaucratic process** also hinders timely project execution (e.g., to meet the required timelines for other planning instruments such as the Municipal Master Plan). Finally, the **lack of stakeholder engagement** early in the process and the municipality's prioritization of other projects have limited progress in advancing land acquisition for biodiversity. Despite these challenges, the potential for land acquisition as a biodiversity conservation tool exists, but it requires increased coordination, expertise, and funding to be fully realized. As the instrument has not been implemented or designed, but merely explored under BioValue, there were no opportunities for trying to overcome some of these gaps.

2.2.3. Information-based instruments

Guidelines for promoting good practices in private spaces

The implementation of guidelines for promoting good practices in private spaces was explored in Trento Municipality, particularly in the context of a new hospital development and the integration of this instrument in the tender process. This integration faced several challenges related to time, institutional alignment, and scientific capacity. The integration of biodiversity considerations into the design of the hospital was constrained by **tight timelines**, which left little room for comprehensive scientific research. Despite the **supportive legal framework** at the provincial level, the **guidelines were non-binding**, making their implementation dependent on cooperation from private stakeholders. This was further complicated by the fact that **biodiversity goals** were secondary to the functional requirements of the

hospital, limiting the emphasis on nature-based solutions in the design process. While **scientific partners** helped gather the necessary data, which was possible under the BioValue project, the municipality faces a lack of internal capacity to lead such specialized efforts in the future. There was also **limited stakeholder engagement** beyond the immediate actors involved in the hospital project, which may have hindered broader participation in the process. Additionally, **vested interests** related to land ownership, particularly by the Defence Ministry, further complicated the integration of biodiversity objectives, with proposed housing development conflicting with the ecological goals for the area. Ultimately, while the guidelines provided an important framework for integrating nature-based solutions in the development, their **voluntary** nature, coupled with competing priorities, meant that biodiversity was still treated as a secondary concern rather than a central goal in implementing the instrument.

Biodiversity monitoring & Ecosystems Services Assessments

The implementation of **biodiversity monitoring and ecosystem services assessments** was explored both in **Mafra** Arena (to support the implementation of land-use zoning schemes and the Master Plan) and **Trento** Arena (to support design-based instruments, specifically the project for the requalification of the Fersina River). In interactions with the municipalities, we have evidenced several significant challenges related mostly to expertise, resources, and institutional coordination. A major gap is the lack of **internal capacity** in both municipalities to manage the technical aspects of biodiversity and ecosystem services, which relies on external experts. This reliance on external support, coupled with limited **funding**, has made it difficult to fully integrate these assessments into the planning process, especially given that biodiversity is often not prioritized in municipal budgets. **Data access and quality** also pose a significant challenge, as municipalities face difficulties in gathering up-to-date, relevant data. This issue is exacerbated by the **disconnect** between scientific research and daily operational practices, making it difficult for technical staff to bridge the gap and apply **scientific findings** in practical planning scenarios. This gap has been addressed under BioValue. Moreover, the complexity of ecosystem services and their communication to stakeholders adds another layer of difficulty for the future implementation of this instrument. The need for clear and actionable **data to support decision-making remains** a persistent barrier to effectively implementing assessments that can support spatial planning.

Though **legal and institutional frameworks** for biodiversity monitoring are usually in place, they are often linked to other instruments and are usually applied hastily and with limited rigor just to comply with vague regulatory requirements. Coordination within municipal departments and between different levels of government can be fragmented, leading to challenges in ensuring that **biodiversity considerations** are effectively integrated across planning sectors. While there is growing **awareness** of the importance of biodiversity, there remains a tendency to prioritize short-term, operational goals over long-term ecological sustainability, and this instrument in then overlooked. Finally, **stakeholder engagement**, while present, is often reactive, and the involvement of local communities and private stakeholders could be more proactive in these assessments. **Vested interests**, especially from development sectors, often conflict with conservation goals, making it difficult to balance the pressures of urban growth with the need for biodiversity protection.

2.3. Key messages

In this chapter we bring forward current gaps for the implementation of a few substantive SP&MIs for biodiversity, as evidenced in articulation with the Arenas for Transformation in BioValue. A common theme across the various instruments analyzed is the significant capacity gaps in expertise, resources, and institutional coordination that hinder the effective implementation of SP&MIs. Additionally, siloed municipal departments and insufficient horizontal collaboration further complicate biodiversity integration into planning processes. Vested interests, particularly from sectors like urban development and agriculture, prioritize short-term economic gains over long-term ecological benefits, creating resistance to biodiversity-focused policies. To address these challenges, governments (and municipalities) must build internal capacity, strengthen legal frameworks, and prioritize biodiversity in planning and budgeting. Enhancing stakeholder engagement, fostering collaboration with scientific partners, and offering financial incentives can help align private interests with public conservation goals. The capacity gaps identified are limited to

the instruments explored in the Arenas for Transformation under BioValue. The assessment framework developed, however, is promising for application to other planning authorities and planning contexts, to cover the full array of SP&MIs identified in this deliverable and potentially identifying additional implementation gaps (and ways to overcome them) to better integrate biodiversity in spatial planning.

3. How SP&MIs contribute to protecting and enhancing biodiversity

3.1. Introduction

The identification of substantive spatial planning instruments for biodiversity presented in this deliverable stems from a collection of both theoretical and practical examples collected throughout previous tasks in BioValue. However, to provide concrete recommendations and define future pathways for biodiversity in and through these SP&MIs, there was the need to determine to what extent is the design and implementation of such instruments effectively contributing to enhancing and protecting biodiversity on the ground.

Considering the relevance of addressing biodiversity along with other environmental challenges in decision-making, we have conducted a detailed contribution analysis of the SP&MIs identified to address the EU Taxonomy environmental objectives (section 3.1.1), with a greater emphasis to objective #6 (the protection and restoration of biodiversity and ecosystems).

Particularly for objective #6, our contribution analysis results from developing a reasonable, plausible causal theory of how the implementation of the instrument can impact biodiversity (i.e., theory of change). We checked for consistency in our causal theory by revising the extensive body of examples and best-practices derived from previous tasks in WP1. In defining the screening criteria that underline our theory of change (section 3.1.2), we privileged the set of key biological principles advanced in the BioValue project Deliverable 2.2 (Kørnøv et al., 2024) (habitat quality, area of habitat, and connectivity).

3.1.1. The EU Taxonomy and its climatic and environmental objectives

The EU Taxonomy Regulation (European Union, 2020) aims to help channel capital towards activities that substantially contribute to reaching the objectives of the European Green Deal, in particular, (1) climate change mitigation, (2) climate change adaptation, (3) the sustainable use and protection of water and marine resources, (4) the transition to a circular economy, (5) pollution prevention and control, and (6) the protection and restoration of biodiversity and ecosystems.

The Taxonomy provided a framework that addresses these objectives in ensemble, to help mitigate the risk of 'greenwashing' and avoid the market fragmentation that can be caused by a lack of common understanding on environmentally sustainable economic activities and their interdependencies. To define when an economic activity makes a substantial contribution to one of the environmental objectives under the EU Taxonomy, headline ambition levels for each objective were defined based on the DPSIR (Driver, Pressure, State, Impact, Response) framework. By applying the DPSIR framework, it was evidenced that all environmental objectives under the EU Taxonomy are interrelated (Figure 2), in terms of the means by which the objective is obtained and the effect it has of obtaining another objective. For instance, while pollution exerts pressure on the environment, affecting the state of biodiversity and ecosystems and water and marine resources, circular economy can be seen as a response to reduce pressure in both.

For the purposes of this deliverable, we have focused mainly on exploring how SP&MIs can contribute to objective 6 of the EU Taxonomy, namely the protection and restoration of biodiversity and ecosystems, expanding on its potential contribution and connections to the other objectives whenever possible.

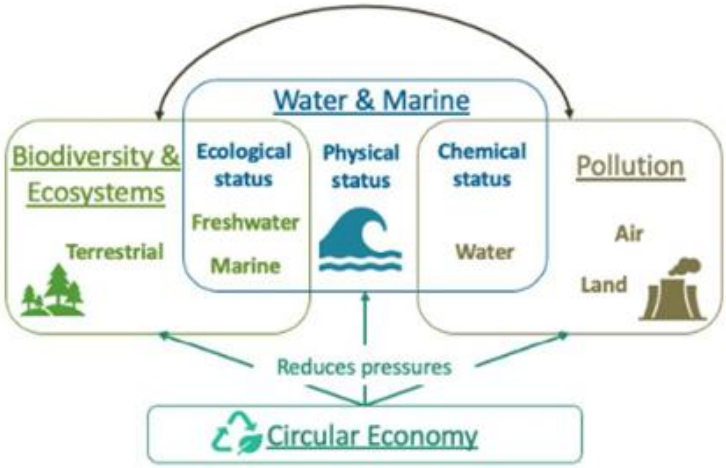

Figure 2: The environmental objectives of the EU Taxonomy Regulation (European Commission, 2023)

3.1.2. Defining Assessment Criteria

To determine if a certain SP&MI is effectively contributing to biodiversity and ecosystems, we refer back to the three biological principles analyzed in the causal-loop diagrams advanced in Project BioValue (D2.2). These principles (Figure 3) are based on the concepts of area-species relationship and the source-sink dynamics of natural ecosystems and have been defined to provide the basis for a deeper understanding of which planning solutions and actions will effectively enhance biodiversity.

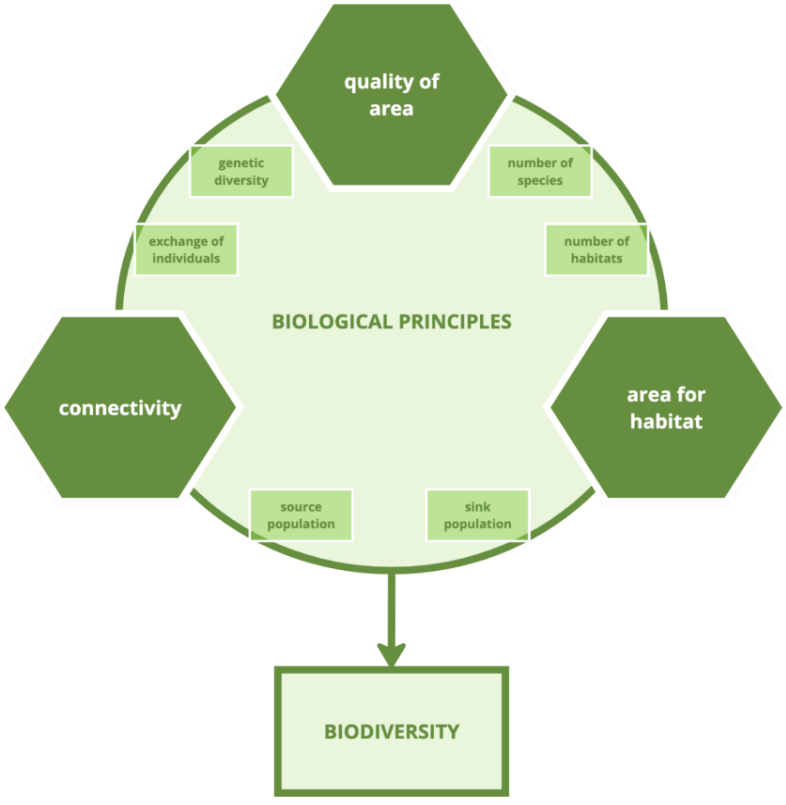

Figure 3: Biological Principles related to biodiversity protection and restoration. (BioValue D2.2 - Kornov et al., 2024).

- **Area of Habitat** The area of habitat represents the total spatial extent available to a species or ecological community. Preserving substantial natural areas is essential for conserving wide-ranging species and maintaining ecosystem functions and potential ES supply at the landscape scale (Pimm et al., 2018). Larger habitats typically support a greater number of species due to the species-area relationship (SAR), which highlights the availability of more resources, microhabitats, and ecological niches in expansive areas (Connor & McCoy, 1979). Large habitats also have higher carrying capacities, allowing them to sustain more individuals and buffer against population declines caused by stochastic events (Storch & Okie, 2019) whereas small habitats are more vulnerable to environmental changes that can lead to population declines. Larger habitat areas are also critical for biodiversity as they reduce "edge effects," where conditions at the boundary are more susceptible to pressure and reinforce negative effects.
- **Quality of Habitat** The quality of habitat is defined by its ability to meet the biological needs of a species, including access to food, water, shelter, and suitable breeding sites. High quality habitats reflect a combination of specific ecological conditions that underline abundant resources and a stable, balanced environment, supporting species-specific requirements such as particular vegetation structures or soil types (Johnson, 2007). Any stress factor impairing such ecological conditions, either physical (e.g., fragmentation), chemical (e.g., pollution) or biological (e.g., invasive species), poses a threat to the overall quality of a habitat. For biodiversity, high-quality habitats ensure healthy populations by fostering reproductive success and resilience to disturbances. In contrast, low-quality habitats often lead to physiological stress and reduced survival rates. Therefore, conservation efforts must prioritize not just the quantity of habitat but also its quality to sustain robust ecosystems.
- **Habitat Connectivity** Habitat connectivity refers to the degree to which habitat patches are linked, enabling organisms to move freely and interact across landscapes. Connectivity supports vital processes such as gene flow, which reduces inbreeding and increases genetic diversity (Lamy et al., 2013). It also facilitates species dispersal for seasonal migrations, resource access, and colonization of new areas. Fragmentation caused by barriers (e.g., infrastructures, managed landscapes, etc.), disrupts connectivity and isolates populations, negatively impacting biodiversity. Well-connected habitats are essential for ecological functions like pollination, seed dispersal, and predator-prey dynamics (Mortelliti et al., 2010). Furthermore, connectivity mitigates the effects of climate change by allowing species to shift their ranges in response to changing conditions (Morelli et al., 2017). Wildlife corridors and ecological networks are vital strategies for conserving biodiversity in fragmented landscapes.

As previously mentioned, the principles of habitat area, quality, and connectivity are deeply interconnected and crucial for enhancing biodiversity. Their interconnectedness is also vital for protecting biodiversity by enhancing ecosystem resilience – for instance large natural areas without sufficient quality or connectivity may still fail to support diverse ecosystems and adapt to change (Nuñez et al., 2013). To this end, the three biological principles here defined have been selected to serve as proxy criteria for understanding how the design and implementation of the different SP&MIs is contributing to objective #6 of the EU Taxonomy Regulation.

To expand our contribution analysis to other climatic and environmental objectives of the EU Taxonomy Regulation (1 to 5), we have focused on reported evidence of the implementation of some SP&MIs from our previous tasks, namely Task 1.1 and Task 1.2. In this regard, we have re-structured our original database to answer a set of questions pertaining to each objective:

- **Objective # 1 climate change mitigation –** Is the instrument design or implementation contributing to increasing carbon sequestration, decreasing deforestation, reducing emissions or increasing land-use and energy efficiency?
- **Objective # 2 climate change adaptation –** Is the instrument design or implementation contributing to decreasing the effects from extreme weather events (e.g., halting or buffering the effects of heatwaves, flooding events, coastal erosion, etc.) or to increasing the resilience of natural ecosystems to such events?

- **Objective # 3 sustainable use and protection of water and marine resources –** Is the instrument design or implementation contributing to protecting or restoring water and marine resources through sustainable water management, land-use practices and infrastructures, urban design or monitoring?
- **Objective #4 transition to a circular economy –** Is the instrument design or implementation contributing to promoting sustainable practices (e.g., regenerative practices, circular agriculture, resource loops, waste recovery, biomass utilization) or to encouraging circular practices in development projects in land management and infrastructure?
- **Objective #5 pollution prevention and control** – Is the instrument design or implementation contributing to preventing and reducing pollution through land use and ecosystem management or to encouraging and monitoring pollution control standards and cleaner practices and technologies?

As the focus of our previous analysis under WP1 was mainly on connections between planning instruments/practices and biodiversity, these other objectives were not necessarily exhaustively covered in our database. In this regard, we have also advanced potential theoretical opportunities and considerations to the implementation of SP&MIs to answer the questions listed above, based on expert judgment. In our results, we highlight the instances of potential contributions that emerge from reported evidence to distinguish them from the other examples that resulted from this solely theoretical contribution exercise.

3.2. Analyzing the capacity of SP&MI to support biodiversity protection and enhancement and other EU taxonomy climate and environmental objectives

3.2.1. Contribution analysis for objective 6: protection and restoration of biodiversity and ecosystems

Using the vast array of implementation examples and best-practices derived from our previous work in WP1, we have performed a contribution analysis to determine if the relationship between the design and implementation of each SP&MIs and the EU taxonomy objective #6 (protection and restoration of biodiversity) is straightforward or conditional/potential, based on criteria given by the three biological principles selected – area of habitat, habitat quality and habitat connectivity. Results are summarized in Table 4. The fully detailed contribution analysis is presented in Annex F.

We defined the types of relationship found as follows:

- **Straightforward** – The implementation of the instrument directly contributes to the achievement of the biological principle, supported by both theoretical potential and documented evidence. This type of contribution is identified in green in Table 4
- **Conditional/Potential –** The implementation of the instrument has a theoretical potential to contribute to the achievement of the biological principle, but only if certain design or implementation conditions are met, and which can be found in the empirical examples analyzed. This type of contribution is identified in yellow in Table 4.

In both instances, we have identified how the contribution could be realized (if conditional) or further strengthened (if straightforward) by implementing the instrument in combination with other SP&MIs. These interactions are also summarized in Table 4 and fully detailed in Annex F.

Table 4 Summary of the contribution analysis between the implementation of SP&MIs and biodiversity restoration and protection. Full a nalysis provided in Annex F.

Green cells indicate straightforward contribution, yellow cells indicate conditional contribution

	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
ENFORCEMENTINSTRUMENTS	**Expropriation of land (including compulsory easements)**				In terms of **habitat quality**, expropriation is effective only when post-expropriation management practices are aligned with ecological maintenance or enhancement goals. Its potential can be amplified by pairing it with qualitative requirements, public development guidelines, or monitoring and evaluation systems to ensure biodiversity objectives are met. For **area of habitat**, expropriation serves as a direct measure to safeguard and expand natural habitats, particularly those at risk due to mismanagement or urban pressures, making it a critical anti-development mechanism for biodiversity preservation. Regarding **connectivity**, expropriation can facilitate habitat linkages, provided it is informed by green infrastructure schemes and spatial analysis tools, such as condition indicators for landscape fragmentation, and supported by ongoing monitoring to maintain connectivity in vulnerable or rapidly urbanizing areas.	*Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity. In this case Information and data are crucial to justify the status of "public use", "public utility", or public interest which, in turn, should justify the enforcement measures like Expropriation (compulsory acquisition) or compulsory easements established by law(defined as strong legal constraints imposed on property owners without transferring ownership).
	Administrative Possession				In terms of **area of habitat** and **habitat quality**, administrative possession serves as a safeguard, maintaining or expanding natural habitats threatened by poor management or neglect, and thus directly contributes to habitat preservation. Nevertheless, its effectiveness can be strengthened by ensuring that adopted post-possession management practices are designed to restore and safeguard ecological conditions. Integration with EA instruments, such as monitoring and condition indicators, is critical to ensuring the long-term ecological integrity of the targeted areas. Regarding **connectivity**, administrative possession can enhance ecological networks, provided that targeted areas are selected with an emphasis on their potential to link existing natural structures. Coupling this instrument with tools like landscape fragmentation indicators can help prioritize interventions in locations where connectivity can be maximized. Additionally, ongoing monitoring programs are vital for ensuring that these linkages remain intact, especially in regions facing intense development pressures.	*Guidelines and recommendation for both public and private development* - to go beyond ownership and make sure the maintenance post-implementation is aligned with the desired ecological conditions of the targeted area *Information-based instruments (Biodiversity monitoring and ES assessments*) – to further support the maintenance or improvement of the ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.

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	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
	Preemption rights				For **habitat quality,** this instrument's success relies on adopting post-acquisition management practices that restore or enhance ecological conditions. Complementary instruments, such as guidelines and recommendations for public development and qualitative requirements, can further improve biodiversity outcomes. Coupling preemption rights with information-based instruments (e.g., biodiversity and ecosystem service data) and EA tools like monitoring and condition indicators ensures that ecological improvements are effectively tracked and maintained over time. Regarding the **area of habitat**, the primary intent of preemption rights is to secure and protect natural habitats from development, ensuring their expansion or at least preservation. In terms of connectivity, preemption rights can contribute significantly when land acquisitions are strategically targeted to reinforce ecological networks. Instruments such as landscape fragmentation indicators can help prioritize acquisitions that enhance connectivity, while ongoing monitoring programs are essential to maintaining these linkages in high-pressure development zones.	*Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity. Depending on national legal system, this instrument, when provided for, is usually used to support *Land Acquisition*. It can also provide opportunity to create *Conservation zones, greenbelts, or protected areas and sites* supported by *Land use zoning schemes in urban or rural spaces at different scales* Can also be used by private entities For example, when implemented in the law, it can be a good measure to stop the fragmentation of agricultural or forestry properties giving this right to the owners that are neighbors of someone that wants to sell its own property. Can also contribute to *land rearrangements*.
REGULATORY INSTRUMENTSS	**Quantitative targets or standards**				Quantitative targets or standards primarily focus on increasing the **area of habitat** through mandated expansions of natural spaces or permeable surfaces. While these instruments have a direct impact on spatial allocations, their ability to improve **habitat quality** is often limited unless accompanied by additional mechanisms. To ensure ecological benefits, the standards should incorporate criteria or thresholds addressing the desired ecological conditions, supported by monitoring programs and condition indicators. Pairing these targets with information-based instruments (e.g., biodiversity and ecosystem service assessments) can further align outcomes with biodiversity goals. In terms of **connectivity**, these instruments have potential when new areas are strategically sited to link with existing natural structures. Implementing quantitative targets through strategic frameworks or in conjunction with land-use zoning can enhance connectivity within urban settings by integrating permeable surfaces or within rural settings by fostering multifunctional habitats. However, their effectiveness depends on careful planning and integration with other SP&MIs to create cohesive ecological networks.	*Qualitative requirements* – to ensure management activities support the desired ecological conditions of the targeted area *Information-based instruments (Biodiversity monitoring and ES assessments*) – to support the maintenance or improvement of the ecological conditions in the targeted area. *Land-use zoning schemes* – to support connectivity of the permeable surfaces (urban settings) or multifunctional habitats (agricultural settings) that are created under these targets.

SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
Qualitative and Technological Requirements				Qualitative and technological requirements focus on specifying ecological characteristics or design elements to be upheld in new or redevelopment projects. These requirements directly support **habitat quality** by guiding the inclusion of ecologically relevant features, such as tree canopy cover or green infrastructure. To maximize their impact, these instruments should be coupled with quantitative targets (e.g., specific percentages or thresholds) and supported by monitoring tools to ensure that qualitative measures are aligned with biodiversity and ecosystem service goals. While these instruments do not inherently expand the **area of habitat**, their implementation may lead to habitat increases in specific cases, particularly when tied to green infrastructure mandates or integrated with quantitative targets. Similarly, their contribution to **connectivity** is indirect and depends on strategic integration with other SP&MIs, such as **land-use zoning**, to ensure that areas subject to these requirements are spatially connected to enhance ecological networks. The strategic coupling of these qualitative measures with other instruments is crucial for achieving broader biodiversity and connectivity objectives.	*Information-based instruments (Biodiversity monitoring and ES assessments*) – to go beyond traditional requirements and focus on the natural elements that actually support the maintenance or improvement of the ecological conditions in the targeted area. *Quantitative targets or standards* – to ensure a net increase in area of habitat considering the development associated with this instrument *Land-use zoning schemes* – to strategically plan which areas will be subject to these requirements.
Compensation measures				The potential of compensation measures to support **habitat quality** lies in their ability to fully address and mitigate ecological damages caused by a project. However, this is contingent upon the careful design and implementation of measures, ideally informed by **biodiversity monitoring** and **ecosystem service (ES) assessments**, to ensure a net ecological benefit. The use of enhancement measures (EAI) and monitoring programs can further strengthen their effectiveness. In terms of contributing to the **area of habitat**, compensation measures are effective only if they result in a net increase in natural habitats beyond the footprint of the impacted area. Coupling these measures with quantitative targets can help ensure this outcome by setting clear benchmarks for habitat restoration or expansion. This was evidenced at the regional scale in the Basque Country Regional Plan. Regarding **connectivity**, compensation measures contribute meaningfully only when the compensated areas are strategically selected to enhance existing ecological networks. This requires integration with EAI tools, such as landscape fragmentation indicators, to prioritize areas with high potential for connectivity. Continuous monitoring is essential to ensure that these connections are maintained and function as intended over time.	*Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area and support design of the necessary measures that will ensure the improvement or maintenance of these conditions *Quantitative targets or standards* – to ensure a net increase in area of habitat considering the damaged caused by the development being compensated for. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.

SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
Performance-based approaches with point systems				In terms of **habitat quality**, these systems should be paired with quantitative or qualitative targets and additional information-based instruments (e.g., biodiversity and ecosystem service assessments) to ensure they promote the desired ecological conditions. Regarding the **area of habitat**, these point systems are mainly applied to green and blue infrastructure, thereby increasing the surface area of natural habitats. However, their impact on connectivity is conditional; they can foster **connectivity** if the point system accounts for landscape fragmentation, potentially enhanced by coupling with environmental assessment tools like landscape fragmentation indicators to better support connectivity across the area.	*Quantitative targets or Qualitative requirements*– to ensure the presence of specific natural elements that contribute to habitat quality in the targeted area, and which should help gauge the level of performance *Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to favor connectivity through the scoring system, depending on location.
Conservation zones, greenbelts, or protected areas and sites				In terms of **habitat quality**, the restrictions on development and specific activities within these areas directly safeguards the ecological conditions of natural habitats. The instrument can be further strengthened by combining it with guidelines, recommendations, and information-based tools, such as biodiversity and ecosystem service assessment, as well as environmental assessment instruments like monitoring and condition indicators. Regarding the **area of habitat**, the establishment of new protected areas or green spaces directly increases habitat area, especially when paired with quantitative targets, such as ensuring a percentage of protected land within a landscape. For **connectivity**, these protected areas can foster habitat linkages if designed as part of a network. This can be supported by environmental assessment tools that monitor landscape fragmentation to guide decisions on new preservation areas, ensuring the maintenance or enhancement of habitat connectivity.	*Guidelines and recommendations for both public and private development* - to go beyond simply regulating protection by ensuring the maintenance of biodiversity values post-implementation, depending on ownership (private or public). *Information-based instruments (Biodiversity monitoring and ES assessments*) – to support the maintenance or improvement of the ecological conditions in the targeted area. *Quantitative targets (i.e., % of protected land within a landscape)* – to go beyond an increase in protected areas but ensure a net increase in the area of habitats being preserved at the landscape scale *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.

SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
Land parcel ownership rearrangements				In terms of **habitat quality**, these rearrangements can enhance the natural habitat if the agreements include protective requirements for natural elements. They can be strengthened by combining them with guidelines for development, qualitative biodiversity requirements, and information-based tools such as biodiversity and ecosystem service assessments, along with environmental assessment instruments like monitoring indicators to ensure the improvement of ecological conditions. Regarding the **area of habitat**, land rearrangements directly facilitate the creation of new natural habitats. Furthermore, they can also improve **connectivity** by creating new, spatially linked habitats. This can be further supported by environmental assessment tools such as landscape fragmentation indicators to identify key areas for intervention, ensuring the establishment of connected habitats.	*Guidelines and recommendations for both public and private development* - to ensure maintenance of biodiversity values post-implementation, depending on ownership (private or public). *Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to further strengthen connectivity by helping to prioritize areas in which to intervene
Land use zoning schemes in urban or rural spaces at different scales				While the management restrictions that come with zoning alone are typically insufficient to enhance **habitat quality**, they can be improved by pairing them with other spatial planning instruments such as guidelines for public and private development, qualitative biodiversity requirements, and information-based tools (e.g., biodiversity and ecosystem service assessments). Evidence of innovative qualitative requirements were found in GDP of Vitoria-Gasteiz. Additionally, environmental assessment instruments like monitoring and condition indicators can help refine zoning restrictions to support ecological improvements. Regarding the **area of habitat**, zoning schemes directly contribute to increasing or maintaining natural habitats, especially when combined with quantitative targets at the local or regional level to ensure a net increase in preserved habitat areas. For **connectivity**, zoning schemes can be effective if they are strategically designed as part of a network to enhance habitat linkages. This approach has been observed in plans like the GDP of Vitoria-Gasteiz, and at a regional planning level with planning recommendations from the Basque Country Regional Plan. Environmental assessment tools, such as landscape fragmentation indicators, can guide decisions on which areas to prioritize for preservation, while monitoring programs can help ensure that connectivity is maintained in areas under pressure from development and urbanization.	*Guidelines and recommendations for both public and private development* - to ensure maintenance of biodiversity values post-implementation, depending on ownership (private or public). *Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area. *Quantitative targets (i.e., % of undeveloped land within a landscape)* – to go beyond an increase in natural areas but ensure a net increase in the area of habitats being kept from development at the landscape scale. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity, including transverse connectivity from the green belt into the urban core (in urban settings).

	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**				These projects are typically designed to enhance the ecological conditions of targeted natural areas through nature-based solutions, thereby directly improving **habitat quality**. They can be further strengthened by integrating guidelines, qualitative requirements for development, and information-based tools like biodiversity and ecosystem service assessments, as well as environmental assessment instruments such as monitoring indicators to track ecological progress. In terms of **area of habitat**, the primary goal of these instruments is to either increase or maintain natural habitats through the implementation of nature-based solutions. For **connectivity**, design-based projects contribute most effectively when they target areas within a spatially connected network. This is particularly true when the projects are part of broader strategic programs to create green networks. This was evidenced in the GDP of Vitoria-Gasteiz, with new GI strategically localized in ecological corridors. To support this, they can be combined with environmental assessment tools, such as baseline assessments, using landscape fragmentation indicators, to guide where interventions are needed, as well as monitoring programs to ensure that connectivity is preserved, especially in areas that may be at risk of development pressures.	*Guidelines and recommendation for both public and private development* - to go beyond the implementation of solutions and make sure the maintenance post-implementation is aligned with the desired ecological conditions of the targeted area *Information-based instruments (Biodiversity monitoring and ES assessments*) – to further support the maintenance or improvement of the ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity. *Incentive instruments (density bonuses, TDR, Fast-tracking approvals and interim uses)* – as the intention of incentives is precisely to influence the design of private projects and promote the preservation and enhancement of biodiversity
	Land acquisition				In terms of **habitat quality**, the impact of land acquisition is contingent on the management practices implemented post-acquisition. These practices should focus on maintaining or improving ecological conditions in the acquired natural areas. The instrument can be further enhanced by integrating guidelines for public development, qualitative biodiversity requirements, and information-based tools (e.g., biodiversity and ecosystem service data), along with environmental assessment instruments like monitoring and condition indicators to track ecological improvements. Regarding **area of habitat**, the primary purpose of land acquisition is to increase or at least preserve natural habitats by preventing them from being developed. For **connectivity**, land acquisition is most effective when it contributes to a network of connected habitats. Evidence of such considerations were found in Lisbon Metropolitan Area Development Plan. Given that available acquisition sites depend on external factors, priority can be given to areas that help expand green networks. This process can be supported by environmental assessment tools such as landscape fragmentation indicators, which can guide decisions on which areas to prioritize for acquisition to ensure enhanced connectivity.	*Guidelines and recommendation for public developments* - to ensure that maintenance post-implementation is aligned with the desired ecological conditions of the targeted area *Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity. Maybe supportive to, or provide, *Design-based instruments* (like the implementation of Projects of different kind) to protect or promoting biodiversity by administration.

	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
	Contractualizations, Partnerships and Stewardships, including Conservation Easements				In terms of **habitat quality**, these instruments include contractual obligations that are designed to maintain or improve the ecological conditions of targeted natural areas, directly contributing to their ecological health. They can be strengthened by incorporating guidelines for both public and private development, qualitative biodiversity requirements, and information-based tools such as biodiversity and ecosystem service assessments, along with environmental assessment instruments like monitoring and condition indicators to track and ensure the ecological improvements for biodiversity. Regarding **habitat area**, these instruments work by restricting or conditioning the development, management, or use of land within targeted natural areas, thereby contributing to the increase or maintenance of natural habitats. For **connectivity**, they can be most effective if implemented in areas that are part of a spatially connected network. This can be supported by environmental assessment tools, such as landscape fragmentation indicators, which can guide decisions on new areas to target, ensuring that interventions enhance habitat connectivity.	*Guidelines and recommendation for both public and private development* - to go beyond the implementation of solutions through contracts and partnerships and make sure the maintenance post-implementation is aligned with the desired ecological conditions of the targeted area *Information-based instruments (Biodiversity monitoring and ES assessments*) – to further support the maintenance or improvement of the ecological conditions in the targeted area. *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**				These guidelines aim to support the restoration or maintenance of desired ecological conditions in targeted areas, directly contributing to **habitat quality**. They can be further strengthened when combined with information-based instruments on biodiversity and ecosystem services, as well as environmental assessment tools such as monitoring and condition indicators, to ensure continued ecological improvement. Regarding the **area of habitat**, these guidelines promote the creation or maintenance of natural areas, and their impact can be maximized when linked to specific development projects with quantitative targets, ensuring a net increase in natural habitat size. For **connectivity**, the effectiveness of this instrument is conditional; it can address connectivity only if the interventions are strategically designed to target spatially connected natural areas, and its impact is amplified when combined with regulatory instruments to ensure compliance and integration into broader green networks.	*Information-based instruments (Biodiversity monitoring and ES assessments*) – to further support the maintenance or improvement of the ecological conditions in the targeted area. *Quantitative targets (i.e., % of natural habitats within a landscape)* – to go beyond an increase in natural areas but ensure a net increase in the area of habitats being kept from development at the landscape scale *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.

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SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
Guidelines for promoting good practices in private spaces				These guidelines aim to support the restoration or maintenance of desired ecological conditions in targeted areas, directly benefiting **habitat quality**. Their effectiveness can be increased when combined with information-based tools on biodiversity and ecosystem services, as well as environmental assessment instruments like monitoring and condition indicators, to track and ensure ecological improvements. Regarding **habitat area**, the guidelines promote the creation or maintenance of natural spaces and are most effective when linked to specific developments, with quantitative targets ensuring a net increase in the size of targeted natural areas. For **connectivity**, the guidelines only contribute to improving habitat linkages if interventions are strategically planned in spatially connected areas. This was evidenced for example in the guidelines for regional planning of the Basque Country. The instrument's impact on connectivity is limited unless paired with regulatory instruments to ensure compliance and integration within broader green networks.	*Information-based instruments (Biodiversity monitoring and ES assessments*) – to further support the maintenance or improvement of the ecological conditions in the targeted area. *Quantitative targets (i.e., % of natural habitats within a landscape)* – to go beyond an increase in natural areas but ensure a net increase in the area of habitats being kept from development at the landscape scale *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.
Biodiversity monitoring & Ecosystems Services Assessments				In terms of **habitat quality**, ecosystem condition indicators, including biodiversity-specific metrics (e.g., species richness and presence of invasive species), help inform the design and implementation of other SP&MIs aimed at improving ecological conditions. These assessments need to address various biodiversity values and be coupled with ecosystem condition indicators or integrated into decision-support systems to effectively contribute to habitat quality. Regarding **habitat area**, ecosystem and biodiversity monitoring indicators help identify natural areas that should be preserved or restored, such as key ecological corridors or nursing habitats, thus guiding targeted conservation actions. For **connectivity**, landscape fragmentation indicators play a key role in improving the design and implementation of SP&MIs that support habitat connectivity. They can also be integrated in environmental assessment tools and monitoring programs to ensure the continued preservation of habitat connectivity. When used to inform decision-making through other SP&MIs, these assessments contribute to the creation of more effective conservation strategies for biodiversity.	*Enforcement, Regulatory, Project/Action-based or Incentive-based instruments* – to ensure that the outcomes of monitoring and condition assessments are used to justify the enforcements and regulatory procedures and support decision-making Biodiversity monitoring is crucial to inform and justify the good designing of new projects and actions (on nature or on built environment). Biodiversity monitoring is also crucial to formulate good monitoring indicators or descriptors (for *quantitative* and *qualitative* metrics) to evaluate performance (*performance-based approaches*), to build *compensation measures* and designing good models of *incentive instruments*.

	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**				For **habitat quality**, density bonuses can be effective if the associated criteria are tied to natural elements (e.g. green roofs) that enhance ecological conditions in the targeted area. This can be strengthened by implementing quantitative standards to ensure habitat quality, as well as integrating information-based instruments on biodiversity and ecosystem services, and environmental assessment tools like monitoring and condition indicators, to verify that the development does not harm surrounding ecosystems (e.g., through increased pollution or traffic). Regarding **habitat area**, density bonuses can contribute to a net increase in natural areas if the criteria support habitat preservation or creation, considering the area being developed or densified. This can be monitored and ensured with the help of environmental assessment tools, such as environmental impact assessments (EIA). For **connectivity**, the bonus system can support habitat linkages if the targeted areas are strategically selected to connect existing natural structures, especially in areas with high potential for connectivity, such as expanding peri-urban regions. This effect can be further enhanced by coupling the instrument with monitoring programs to ensure that habitat connectivity is maintained and not disrupted by surrounding development.	*Qualitative requirements*– to ensure that the criteria associated with the bonuses can contribute to enhancing habitat quality *Information-based instruments (Biodiversity monitoring and ES assessments*) – to ensure that the criteria associated with the bonuses are related to natural elements that support the ecological quality condition of the targeted area *Quantitative targets or standards* – to ensure a net increase in area of habitat considering the development associated with this instrument *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize intervention through bonuses in areas with higher potential for habitat connectivity

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	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
	Transfer of development rights (TDR) mechanisms				TDRs can support the maintenance or improvement of ecological conditions in targeted natural areas, directly enhancing **habitat quality**. This impact can be further supported by coupling TDRs with guidelines and recommendations for public and private development, qualitative biodiversity requirements, and information-based instruments (e.g., biodiversity and ecosystem services data), as well as environmental assessment tools like monitoring and condition indicators to track and verify ecological improvements. Regarding **habitat area**, TDRs work by conditioning the development, management, or use of land in targeted natural areas, thereby contributing to the preservation or creation of natural habitats. TDRs can be particularly effective if the transferred development rights are used to protect or restore natural areas which form the originating areas of TDRs. For **connectivity**, TDR mechanisms support habitat linkages if the targeted areas are spatially connected with other natural or undeveloped areas. To ensure that connectivity is maintained, TDRs can be integrated with environmental assessment instruments, such as landscape fragmentation indicators, and paired with monitoring programs to ensure that surrounding natural areas are not adversely affected by development.	*Guidelines and recommendation for both public and private development* - to go beyond the implementation of the instrument and make sure the maintenance post-implementation is aligned with the desired ecological conditions of the targeted area *Information-based instruments (Biodiversity monitoring and ES assessments*) – to further support the maintenance or improvement of the ecological conditions in the targeted area. *Quantitative targets (i.e., % of natural habitats within a landscape)* – to go beyond an increase in natural areas but ensure a net increase in the area of habitats being kept from development at the landscape scale *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity. TDRs are in general related with development projects influencing the design of solutions and allowing the preservation of environmental and biodiversity values.

SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY	SUMMARY OF CONTRIBUTION ANALYSIS	INTERACTIONS WITH OTHER SP&MIs TO SUPPORT BIODIVERSITY
Fast-tracking approval process				This instrument can support biodiversity if the greening interventions incorporated in the projects are aligned with natural elements that support ecological integrity. To ensure **habitat quality**, this instrument should include qualitative requirements and can be paired with information-based instruments (e.g., biodiversity and ecosystem services data) as well as environmental assessment tools like monitoring and condition indicators to verify the ecological benefits of the interventions. Regarding **habitat area**, fast-tracking approval can support a net increase in natural areas, especially if the greening interventions contribute to habitat creation or preservation while accounting for any development or urbanization associated with the project. This can be ensured by coupling the instrument with environmental assessment tools such as environmental impact assessments (EIA). For **connectivity**, the instrument can only effectively contribute to habitat linkages if the greening interventions create connections with existing natural structures. Although the selection of areas is predetermined by specific project locations, priority can be given to projects in areas with high potential for connectivity, such as expanding peri-urban areas. Additionally, this instrument should be coupled with monitoring programs to ensure that connectivity is maintained and not disrupted by surrounding development.	*Qualitative requirements*– to ensure that the criteria required for projects to be eligible can contribute to enhancing habitat quality *Information-based instruments (Biodiversity monitoring and ES assessments*) – to ensure that the criteria associated with fast-tracking are related to natural elements that support the ecological quality condition of the targeted area; and to give reference data and indicators to measure the merit of projects and justify the application of incentives *Quantitative targets or standards* – to ensure a net increase in area of habitat considering the development associated with this instrument *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize projects in areas with higher potential for habitat connectivity
Interim use permits (abandoned/vacant lots)				These permits can support ecological conditions if the terms of use are linked to natural elements that promote **habitat quality**. To ensure the desired ecological outcomes, these permits can be coupled with qualitative requirements, information-based instruments (e.g., biodiversity and ecosystem services assessments), and environmental assessment tools such as monitoring and condition indicators. Regarding **habitat area**, interim use permits can help maintain or increase natural areas, particularly by focusing on green or blue infrastructure in vacant or abandoned lots. By conditioning land use, these permits directly contribute to preserving or expanding natural habitats. For **connectivity**, the effectiveness of this instrument depends on the spatial connection of the targeted areas with other natural or undeveloped areas. Since interim use permits are tied to specific locations, priority should be given to areas with higher potential for connectivity, such as peri-urban zones. This instrument should also be supported by monitoring programs to ensure that connectivity is maintained, especially as surrounding natural areas may be subject to development that could disrupt connectivity.	*Guidelines and recommendations for private development* - to ensure maintenance of biodiversity values post-implementation *Information-based instruments (Biodiversity monitoring and ES assessments*) – to help determine desired ecological conditions in the targe; and to give reference data and indicators to measure the merit of projects and justify the application of incentives ted area; *Information-based instruments (Condition Assessments using landscape fragmentation indicators)* – to help prioritize areas in which to intervene and support connectivity.

3.2.2. Potential contribution to other climate and environmental objectives of the EU Taxonomy

We have also expanded the contribution analysis exercise to determine the potential contribution of these instruments to the other climatic and environmental objectives of the EU Taxonomy (Table 5). Most of the potential contributions listed emerge from a purely theoretical and expert-based exercise. However, in some instances these contributions are backed-up by the examples examined in previous tasks within WP1, which are then further explained and highlighted in our results – in green.

Table 5: Potential contributions of the implementation of SP&MIs to the EU Taxonomy Regulation climatic and environmental objectives.

Highlighted cells (green) indicate contributions evidenced in Task 1.1 (spatial plans), Task 1.2 (planning best-practices) or Task 1.3 (ES assessment in the Arenas).

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
ENFORCEMENT INSTRUMENTS	**Expropriation of land**	Enables reforestation on reclaimed lands. Protects critical ecosystems to maintain carbon sinks like forests and wetlands.	Secures strategic locations for flood buffers or climate-adapted land-use practices	Protects critical watersheds and coastal zones (potentially even restoring wetlands or mangroves), safeguarding water resources by restricting harmful development in these areas.	Redirects development away from areas that can be of interest for circular systems, such as urban gardens.	Controls pollution by repurposing contaminated lands for safe uses like green buffers. May reduce pollutants by reclaiming land for green zones or ecological restoration from industrial development.
	Administrative Possession					
	Preemption rights					
REGULATORY INSTRUMENTS	**Quantitative targets or standards**	Reduces emissions by setting limits on energy use, construction standards, or deforestation.	Ensures minimum green space or buffer zones to absorb climate impacts like heatwaves and water runoff. *Harmonization of standards for rezoning building zones, ensuring equitable development resilient to climate change (GDP Bellinzona)*	Establishes water usage caps, runoff standards, and wastewater treatment requirements.	Enforces resource efficiency targets, such as recycling quotas, waste reduction, or material reuse.	Establishes caps or thresholds for pollutants, such as air and water quality standards *Mandated % decrease in usage of chemical pesticides and fertilizers in farming (Partial Territorial Plan of Central Álava)..*

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
	Qualitative and Technological Requirements	Encourages energy-efficient buildings and renewable energy use. Encourages afforestation. *Designing requirements for nature-friendly mobility evidenced in the Central Àlava Partial Territorial Plan* *Mandating municipal or inter municipal planning for vacant spaces, envisioning park and forest areas for leisure, barring soil sealing (Emilia Romagna Regional Plan)*	Promotes use of materials and designs resilient to extreme weather events	Implements water-efficient technologies, stormwater management systems, and pollution filters.	Encourages use of sustainable, recyclable, or biodegradable materials in infrastructure and construction.	Promotes cleaner technologies and processes that reduce waste, runoff, and emissions.
	Compensation measures	Offsets emissions by mandating restoration or afforestation projects. *Found in various examples*	Creates additional climate-resilient ecosystems or stormwater management areas.	Requires restoration of degraded aquatic habitats like rivers, wetlands, or coral reef *Compensation for water pond damages foreseen in the Skive Municipal Plan.*		Requires polluters to restore or mitigate environmental harm, improving air, soil, and water quality.
	Performance-based approaches with point systems	Incentivizes carbon-neutral or energy-efficient developments.	Rewards development designs incorporating water management or flood resistance.	Incentivizes green infrastructure projects that advance rain gardens and permeable pavements for water protection.	Encourages green infrastructure projects that use recycled materials, incorporate zero-waste designs, or minimize resource inputs.	Rewards pollution-reducing practices, such as water filtration or emission controls in development projects.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
	Conservation zones, greenbelts, or protected areas and sites	Preserves carbon-sequestering ecosystems such as forests and wetlands. *Found in various examples*	Maintains biodiversity and contributes to ecosystem resilience.	Protects critical watersheds and coastal zones (potentially even restoring wetlands or mangroves), safeguarding water resources by restricting harmful developments. *Classify valuable headwater zones and related watersheds as protected areas* (Basque Country Regional Planning)		Protected areas act as natural filters, reducing air and water pollution and trapping sediments or toxins.
	Land parcel ownership rearrangements	Enables land-use efficiency, e.g., *creating contiguous green zones that promote carbon sequestration* (as intended in the exampled explored in the Meck-Pomm Arena)	Facilitates strategic realignments for flood management or habitat migration corridors.	Restructures land use to conserve water resources and prevent overuse or contamination of watersheds.	Optimizes land-use distribution for co-located activities that enable circular systems (e.g., industrial symbiosis).	Optimizes land-use distribution to prevent polluting industries from encroaching on sensitive areas.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
	Land use zoning schemes in urban or rural spaces at different scales	Regulates urban sprawl and can support transit-oriented development, lowering emissions. *Imposes land-use restraints in areas with carbon sequestration potential (GDP Vitoria-Gasteiz).*	*Identifies zones vulnerable to climate impacts and restricts risky developments in such areas (Cairngorms Park Plan).* *Acknowledging environmental networks (and respective zoning) as essential infrastructures linking city zones and integrating Nature Based Solutions for climate adaptation (GDP Bologna)* *Building zones are reorganized following a development methodology with climate adaptation-oriented planning to improve the resilience and well-being of citizens.(GDP Bellinzona)*	Various possibilities through land-use zoning, including removing industries and limiting intensive agriculture in water-critical zones, and promoting buffer zones along waterways. *Including surface water protection as a non-developable category (GDPV Vitoria Gasteiz)* *Riverbed widening and naturalistic interventions (GDP Bellinzona)* *Ensuring coherence of zining with Water Protection Regulations from Regional legislation (Cantonal-Ticino Master Plan)*	Encourages zoning for recycling facilities, resource recovery centers, and mixed-use resource sharing hubs. *Re-zoning agricultural areas as non-developable and highly protected agricultural land categories to uphold their agricultural value, strengthening local food production and curbing transportation expenses (GDP Vitoria-Gasteiz).*	Segregates pollutive activities from residential or ecological zones to limit exposure to pollutants.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**	Promotes energy-efficient urban designs and compact development. *Initiatives for permeable parking lots and clear mixtures for sidewalks and bicycle and pedestrian paths (GDP Bellinzona)*	Encourages designs that integrate water management and green infrastructure. *Infiltration trenches and vegetated detention ponds to manage stormwater and prevent local flooding (GDP Vitoria Gasteiz)*	Encourages specific design solutions with rainwater harvesting, flood management, and water filtration systems. *Promotes effective urban drainage management through the integration of nature-based solutions (GDP Vitoria Gasteiz)*		Incorporates stormwater management, reduced runoff, and air pollution controls in urban designs. *The implementation of constructed wetlands takes precedence over engineering solutions for stormwater treatment (Territorial Plan Central Alava)* *Promotion of the use of clear synthetic materials in plazas intended for play (GDP Bellinzona)*
	Land acquisition	Acquires land for renewable energy, carbon offsets, or conservation projects., contributing to carbon sequestration.	Secures areas for flood defense or managed retreat from vulnerable coastal areas.	Protects critical watersheds and coastal zones (potentially even restoring wetlands or mangroves), safeguarding water resources by restricting harmful developments.	Redirects development away from areas that can be of interest for circular systems, such as urban gardens.	Converts polluted or degraded lands into green spaces that trap pollutants and restore ecosystems.
	Contractualizations, Partnerships and Stewardships, including Conservation Easements	Supports community-driven renewable energy projects or conservation schemes that may contribute to carbon sequestration.	Enhances adaptive land management practices with local partnerships.	Promotes collaborative water management and protection, such as community-led wetland restoration projects.	Encourages partnerships for circular projects, like local composting, repair programs, or resource sharing.	Engages stakeholders to collaboratively reduce pollution through conservation and sustainable practices.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**	Encourages low-emission transport options like biking and walking pathways by creating ad-hoc development guidelines *Incorporating such guidelines in municipal planning (various municipal planning documents)*	Designs public spaces that cool urban areas and manage stormwater.	*Prioritizes planning actions to preserve and restore the dynamics and morphology of fluvial ecosystems, wetlands and estuaries (Guidelines for Regional Planning Basque Country)* Recommends stormwater management features like bioswales and permeable pavements to protect water resources. Recommends practices and land-uses that are less water demanding and promote water efficiency.	Promotes circular designs in public spaces, such as using recycled materials and prioritizing durability. *Land bank programs for the new agricultural models (Basque Country Regional Planning Guidelines)*	Reduces urban pollution through better stormwater systems, air quality improvements, and sustainable landscaping.
	Guidelines for promoting good practices in private spaces	Promotes renewable energy use or sustainable agriculture on private lands.	Encourages climate-resilient practices like rainwater harvesting or drought-resistant landscaping (e.g., floodplain protection at Cairngorms Park Plan).	Recommends stormwater management features like bioswales and permeable pavements to protect water resources. Recommends practices and land-uses that are less water demanding and promote water efficiency. *Guidelines with optimal bioclimatic practices from various manuals tailored to the municipality's context* (GDP Vitoria Gasteiz).	Can integrate recycling, reusing, and self-composting principles to reduce pollutant release by private agents. *Can also support enhanced waste disposal control* (GDP Vitoria-Gasteiz)	Minimizes pollution by promoting organic farming, reducing chemical use, and implementing clean technologies.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
	Biodiversity monitoring & Ecosystems Services Assessments	*Identifies key carbon-rich areas for protection via zoning and restricting development (Mafra Arena)*	Assesses and monitors ecosystems' ability to buffer against climate impacts like floods or droughts.	Monitors aquatic ecosystem health and supports measures to protect water-related biodiversity and ecosystem services.	Monitors resources and waste flows to identify opportunities for circular economy interventions.	Monitors pollution impacts on ecosystems and identifies mitigation measures for water, air, or soil health.
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	Encourages compact, mixed-use developments that reduce transportation emissions.	May reduce exposure in hazardous zones by encouraging a more compact urban structure (e.g., decreasing the need to expand development to outer parts of cities in coastal cliffs, mountain slopes, river banks, etc.). May favour development that includes adaptation measures.	Reduces impervious surfaces, promoting groundwater recharge and limiting water pollution.	Incentivizes developments that integrate circular systems by encouraging more compact urban structures – increasing the chances for shared services and resource efficiency	Limits urban sprawl, reducing car dependency and air pollution while protecting natural areas.
	Transfer of development rights (TDR) mechanisms	Redirects development away from carbon-rich zones	Protects critical areas for flood management or other adaptive purposes, depending on location.	Prevents overexploitation of water and marine resources by protecting critical aquatic ecosystems, redirecting development from critical zones.	Redirects development away from areas that can be of interest for circular systems, such as urban gardens.	Reduces pollution by limiting industrial activities in ecologically sensitive or urban areas.
	Fast-tracking approval process	Accelerates low-carbon infrastructure or renewable energy projects.	Facilitates timely implementation of adaptive projects like flood defenses.	Speeds up the implementation of projects and initiatives integrating efficient water management solutions.	Speeds up the implementation of projects and initiatives integrating recycling facilities, upcycling solutions, or renewable energy systems.	Expedites pollution control projects such as waste treatment plants or clean energy facilities.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	#1 Climate Change Mitigation	#2 Climate Change Adaptation	#3 Sustainable use and protection of water and marine resources	#4 Transition to Circular Economy	#5 Pollution Prevention and Control
	Interim use permits (abandoned/vacant lots)	Utilizes vacant land for urban gardens, afforestation or renewable energy installations, contributing to carbon sequestration. *(Lisbon Metropolitan Area Plan)*	Provides temporary flood water retention or cooling zones, depending on location.	Protects critical watersheds and coastal zones, depending on location. Enables interim use of land for water collection systems.	Enables temporary uses that contribute to improved consumption patterns like community gardens or zero-waste community initiatives.	Reduces pollution by turning vacant lots into green infrastructure or areas that filter air and water pollutants. *Transforming abandoned urban spaces for managing stormwater (GDP Vitoria-Gasteiz)*

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3.3. Key messages

In this chapter we have explored how different SP&MIs, individually and in combination, can contribute to supporting biodiversity (by increasing area of habitat, habitat quality and connectivity). We also explore how the implementation of these SP&MIs can theoretically contribute to supporting other environmental and climate objectives, highlighting evidence found in the practical examples analyzed.

Our contribution analysis shows that most of the SP&MIs are only directly contributing to an increase in area of habitat, while conditionally contributing to habitat quality and connectivity. To address habitat quality, most of the SP&MIs need to be coupled with other instruments such as Biodiversity and ES assessments, to help determine the desired ecological condition and biodiversity values to be restored, preserved or enhanced through the instrument. Additionally, most SP&MIs also need to be coupled with development guidelines and recommendations or specific qualitative requirements to ensure maintenance or enhancement of habitat quality. Finally, to address habitat connectivity, all of the SP&MIs analyzed would benefit from condition assessments using landscape fragmentation indicators to help either target or prioritize areas in which to intervene. Habitat connectivity can also be better supported in SP&MIs when integrated in strategic planning, as evidenced by some of the practical examples analyzed. Though most SP&MIs are directly contributing to increasing area of habitat, we also provide evidence on how this contribution can be further strengthened by ensuring a net increase at the landscape scale (considering that most instruments are tied to development projects), by using different SP&MIs in combination.

From the examples of instrument implementation analyzed there was evidence to suggest that, when implemented, these SP&MIs can also support other objectives of the EU Taxonomy Regulation. In particular, there was practical evidence of various instruments being implemented to support climate objectives (both adaptation and mitigation) as well as objective #3 (water resources). The SP&MIs for biodiversity for which there was a higher number of evidence of potential support to other environmental and climate objectives was *land-zoning*, *design-based instruments* and *guidelines for private/public developments*.

4. The Transformative Change Potential of SP&MIs

4.1. Introduction

In Deliverable 4.1, the BioValue team has tailored the analytical framework for transformative change proposed by Wittmer et al. (2021)into the spatial planning context. This 5-part analytical framework stems from *visions* (what futures do we want?), *knowledge* (what needs to be known for a changing system?), and *dynamics* (how to navigate, nudge, and nurture system change?), which leads to *emancipation and agency* (how to open spaces for deliberation, inclusion, and emancipation?) and, finally, *governance* (which represents an adequate combination of actors, instruments, and modes). In tailoring this analytical framework to the spatial planning context, the team has subsumed the ambitions proposed in *visions* into three:

- **Ambition 1**: **spatial planning safeguards, restores, allows recovery and enhances biodiversity**. As is emphasized in target 1 of the *Kunming-Montreal Global Biodiversity Framework*, inclusive spatial planning should be ensured to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030. Here, spatial planning usually operates in direct ways by reducing or enhancing certain uses in certain areas. Examples of approaches that significantly contribute to this ambition are Nature-based solutions and ES.
- **Ambition 2: spatial planning significantly contributes to balanced and responsible consumption and production without external social and environmental costs**. Here, the effects of spatial planning can induce more balanced, sustainable territorial relations between urban, peri-urban and rural communities. Examples of approaches to contribute to this ambition are reducing (and stopping) land take and land consumption and urban food system production.
- **Ambition 3: spatial planning significantly contributes to reducing socioeconomic inequalities**, for example, in the context of urban areas, which is reflected, e.g., in unequal access to transport, housing, among others that primarily affect the integration of marginalized communities, migrants, youth, and disadvantaged groups.

As such, the transformative potential of a spatial planning instrument towards a sustainable management of biodiversity can be understood as its potential to contribute to these three ambitions, i.e., (i) it safeguards, restores, allows recovery and enhances biodiversity and ecosystem services as global commons (e.g., NbS), (ii) it promotes balanced and responsible consumption and production (e.g., stopping or reducing land take), (iii) it reduces socioeconomic inequalities.

In the present deliverable, we have assessed the transformative potential of each substantive SP&MI individually by answering a set of questions defined in Deliverable 4.3 (Locher-Krause et al., 2024) pertaining to each ambition (Table 6).

Table 6: Criteria to assess the transformative change potential of substantive SP&MIs. Adapted from D4.3 (Locher-Krause et al., 2024).

	Ambition #1 Spatial planning safeguards, restores, allows recovery and enhances biodiversity	Ambition #2 Spatial planning significantly contributes to balanced and responsible consumption and production without external social and environmental costs	Ambition #3 Spatial planning significantly contributes to reducing socioeconomic inequalities.
QUESTIONS FOR ASSESSMENT OF EACH INSTRUMENT	How and how much does the instrument contribute to safeguarding, restoring, allowing recovery, promoting and enhancing biodiversity and ecosystem services? Based on the contribution analysis of Chapter 3, we answer this question by indicating straightforward or conditional contribution of the SPM&I to habitat quality, area of habitat and habitat connectivity. We have considered as direct potential to contribute to Ambition 1 when at least two of the biological principles are directly supported by the instrument. These are highlighted in green in Table 6.	Analyzing if the SP&MI contributes directly or indirectly/conditionally to avoiding/reducing social and environmental impacts and costs? If the SP&MI contributes directly or indirectly/conditionally to uncovering and (if possible) internalizing the social and ecological costs of (economic) activities? And if the SP&MI contributes directly or indirectly/conditionally to reducing "consumption" i.e., less need for energy/transport, dietary shift to less resource-intense food?	Analyzing if the SP&MI contributes directly or indirectly/conditionally to enhancing access to benefits coming from biodiversity and ecosystem services in order to increase human well-being for all? If the SP&MI could directly or indirectly/conditionally contribute to addressing the unfair distribution of benefits/opportunities/healthy living conditions?
RELEVANT CONSIDERATIONS IN ANSWERING THE QUESTIONS	*Check if the instrument is not unintendedly shifting costs to other sectors, landscapes, or actors unless that contributes to reducing social inequality. Please include situations in which a not well-planned design/implementation could lead to shifting costs to other sectors (use examples if needed)*	*Check if the instrument is not unintendedly increasing resource intensity in some part of the production process*	*Check if the instrument is not unintendedly increasing socioeconomic inequality in terms of access or benefits*

4.2. Analyzing how SP&MIs can help address the ambitions for Transformative Change

Based on the assessment questions identified, we assessed how each of the SP&MIs analyzed could contribute to each transformative change ambition. Results are summarized in Table 7, below. The full analysis is presented in Annex G.

We defined the types of relationship found similarly to our previous contribution analysis, as follows:

- **Straightforward** – The implementation of the instrument directly contributes to the ambition. This type of contribution is identified in green in Table 7
- **Conditional/Potential –** The implementation of the instrument has a theoretical potential to contribute to the ambition, but only if certain design or implementation conditions are met. This type of contribution is identified in yellow in Table 7

Additionally, based on the relevant considerations presented previously in Table 6, we identified potential conflicts that may arise from the implementation of the instrument. These are represented by the symbols in Table 7.

Table 7: Summary of the contribution analysis between the implementation of SP&MIs and the three ambitions for transformative change. Full analysis in Annex G.

Green cells indicate a straightforward contribution, yellow cells indicate a conditional relationship. Symbols ⚠ indicate possible conflicts identified.

	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1	AMBITION #2	AMBITION #3	SUMMARY OF CONTRIBUTION ANALYSIS
ENFORCEMENTINSTRUMENTS	**Expropriation of land**		⚠	⚠	Expropriation of land and the change of ownership from private to public entities holds potential to safeguard and enhance biodiversity by increasing natural habitat areas. It can conditionally improve habitat quality, and enhance ecosystem connectivity, especially when paired with complementary measures. However, it poses risks, such as shifting costs to public budgets or other sectors (e.g., agriculture, forestry), and may negatively impact biodiversity and livelihoods under weak governance. There are many examples where countries (in particular underdeveloped countries) use expropriation to take land from local communities with the frequent argument of defending natural resources and creating development for all, which will later be granted to private companies for their exploitation, often with little control and great loss of biodiversity. While it prevents environmentally harmful activities and helps preserve ecosystems, it can lead to social resistance and displacement due to inequities in implementation. Its potential to reduce socio-economic inequalities depends on equitable post-expropriation management, such as land redistribution for conservation or affordable housing, although its enforcement nature limits participatory processes.
	Administrative Possession		⚠		Administrative possession demonstrates good potential to safeguard and enhance biodiversity by increasing habitat area and is usually focused on improving habitat quality. It can and address connectivity, particularly when paired with complementary instruments. It can increase ecosystem service supply, especially in urban contexts, but may shift management and maintenance costs to public institutions. While it helps preserve ecosystems, reduces pollution, and improves environmental quality for nearby residents, it may encounter social resistance. Its contribution to reducing socio-economic inequalities depends on how public institutions prioritize access for underserved communities or local resource use. This measure largely depends on the legal framework of each country. It works well in urban areas in relation to buildings but requires great commitment and management capacity by the local authority.
	Preemption rights		⚠		Preemption rights as a spatial planning instrument has potential to safeguard biodiversity by increasing habitat areas. It can conditionally improve habitat quality, and enhance ecosystem connectivity, especially when paired with complementary measures. This instrument can enhance ecosystem service supply across urban, rural, and peri-urban contexts, though it may shift maintenance and management costs to public institutions. By prioritizing conservation-focused activities post-implementation, it protects ecologically significant lands from harmful development but its implementation may face social resistance. Its ability to reduce socio-economic inequalities depends on its application, such as ensuring access to resources for vulnerable groups through affordable housing or community land trusts with clearly defined conservation goals.

	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1	AMBITION #2	AMBITION #3	SUMMARY OF CONTRIBUTION ANALYSIS
REGULATORY INSTRUMENTsS	**Quantitative targets or standards**		⚠		Quantitative targets or standards have potential to safeguard and enhance biodiversity by increasing habitat area. It can conditionally improve habitat quality, and enhance ecosystem connectivity, especially when paired with complementary measures. However, uneven application may shift compliance costs to developers, manufacturers, or farmers, impacting sectors like construction (e.g., housing prices) and agriculture (e.g., food prices). The instrument can enhance urban micro-climate regulation, reduce energy consumption, and expand tree canopy cover, though higher compliance costs could burden consumers. While typically applied to private areas, it has the potential to supply public ecosystem services, improving health outcomes for low-income groups disproportionately affected by pollution and narrowing health inequalities.
	Qualitative and Technological Requirements		⚠		Qualitative and technological requirements have potential to enhance biodiversity by improving habitat quality and connectivity, particularly when combined with quantitative targets or other measures. They can increase area of habitat depending on the type of requirements. They can increase ecosystem service supply across urban, rural, and peri-urban contexts but may shift costs to sectors needing to adopt higher standards or technologies, such as construction (affecting housing prices) and agriculture (raising food costs). These requirements can reduce pollution, enhance water management, and decrease runoff, but financial barriers may arise for smaller businesses. By potentially fostering green jobs and upskilling, especially in low-income sectors, the instrument supports a transition to cleaner technologies.
	Compensation measures	⚠	⚠	⚠	Compensation measures have conditional potential to support biodiversity by increasing habitat area, quality, and connectivity, provided they are well-implemented and combined with other instruments. While they can enhance ecosystem service supply across various contexts, they risk shifting environmental costs to other landscapes by permitting localized development or damage. Social inequities may arise if offsets are located far from impacted communities, limiting their benefits. However, if compensation occurs locally, it can create jobs, improve access to green spaces for underserved populations, and foster socio-economic equity. Otherwise, it can create greater social imbalances in the distribution of benefits.
	Performance-based approaches with point systems		⚠	⚠	Performance-based approaches with point systems show potential to enhance biodiversity by increasing habitat area. It can conditionally improve habitat quality, and enhance ecosystem connectivity, especially when paired with other instruments. They incentivize higher environmental standards, such as expanding green and blue infrastructure, though they may require costlier design and planning, creating barriers for smaller or underfunded actors. When used on public investments, this instrument can promote equitable access to sustainable spaces and improve public space inclusivity, fostering social cohesion. However, high implementation costs associated with “best-performance” could limit implementation and potentially limit their broader socio-economic impact.

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	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1	AMBITION #2	AMBITION #3	SUMMARY OF CONTRIBUTION ANALYSIS
PROJECT OR ACTION-BASED INSTRUMENTS	**Conservation zones, greenbelts, or protected areas and sites**		⚠	⚠	Conservation zones, greenbelts, and protected areas have strong potential to safeguard and enhance biodiversity by expanding habitat areas and improving habitat quality. They can support connectivity, particularly when integrated with complementary instruments. They boost ecosystem service supply across urban, rural, and peri-urban contexts but may shift economic activities to less-regulated areas, increasing development pressures elsewhere. While such measures can restrict traditional economic activities like farming or extraction, they enhance community well-being by preserving cultural landscapes, providing recreational spaces, and opening opportunities in sustainable tourism. However, they may compete with land availability for housing or social development projects, which can be addressed through participatory processes.
	Land parcel ownership rearrangements	⚠	⚠		Land parcel ownership rearrangements have a good potential to enhance biodiversity by increasing habitat areas and improving connectivity. They can address habitat quality, particularly when supported by effective management and complementary instruments. However, when used to enable an increase of mechanization and industrialization of agricultural and forestry activity, they can negatively impact biodiversity. These rearrangements can boost ecosystem service supply in diverse contexts but may impose administrative, legal, and financial burdens on stakeholders, such as costs tied to new farming practices or equipment upgrades (as a result from new land management required post-rearrangement). By enabling more sustainable and efficient land use, this approach can reduce habitat fragmentation and improve land allocation equity, though it may also spark conflicts over ownership. Participatory processes and stakeholder engagement are key to ensuring fair outcomes and addressing socio-economic inequities.
	Land use zoning schemes in urban or rural spaces at different scales		⚠		Land use zoning schemes in urban and rural spaces offer potential for safeguarding biodiversity by increasing habitat area. It can enhance habitat quality and improve connectivity, particularly when paired with other instruments. These zoning schemes can boost ecosystem service supply, especially in urban settings, but may shift costs to sectors affected by zoning restrictions, such as businesses and construction firms, and could impact the housing market. By directing development away from sensitive areas, zoning may reduce environmental hazards and improve living conditions, although it may limit affordable housing or economic opportunities in restricted zones. Well-implemented zoning can protect communities from industrial encroachment, promote mixed-use development, and improve access to services and jobs, benefiting socio-economic equity.
	Design-based instruments		⚠		Design-based instruments have significant potential to enhance biodiversity by increasing habitat areas and improving habitat quality, and potentially supporting connectivity, particularly in urban settings. When combined with other tools, they can boost ecosystem service supply, though they may shift maintenance and management costs to public institutions, potentially impacting affordability for users, especially if access to intervention areas becomes restricted. These instruments promote sustainable urban design, improving livability and aesthetics, but may contribute to gentrification, making housing or spaces less accessible to low-income groups. However, when applied as strategic plans or programmes, they can rehabilitate neglected neighborhoods, reduce inequalities in access to green spaces, and improve social cohesion, especially if public participation is prioritized in the design process.

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	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1	AMBITION #2	AMBITION #3	SUMMARY OF CONTRIBUTION ANALYSIS
INFORMATION-BASED INSTRUMENTS	**Land acquisition**		⚠		Land acquisition instruments have potential to enhance biodiversity by increasing habitat areas and improving habitat quality and connectivity, particularly when combined with other measures. They can boost ecosystem service supply in urban contexts, but the costs are typically shifted to public entities or donors, with potential opportunity costs for other investments. While land acquisition by public authorities provides long-term public benefits through conservation, it may disrupt local communities and livelihoods if not managed equitably. When executed properly, it ensures long-term benefits for communities by securing land for public use or conservation, particularly in under-resourced areas, thus contributing to reducing socio-economic inequalities.
	Contractualizations, Partnerships and Stewardships, including Conservation Easements		⚠		Contractualizations, partnerships, and stewardship agreements, including conservation easements, have strong potential to enhance biodiversity by increasing habitat area, improving habitat quality, and supporting connectivity, especially when combined with other instruments. They can also boost ecosystem service supply across urban, rural, and peri-urban contexts. However, they may shift maintenance and management costs to partners responsible for upholding stewardship obligations, with costs potentially shared depending on contract terms. These instruments encourage community involvement and shared benefits, though they may lead to uneven distribution of responsibilities and benefits among stakeholders. When applied to restore neglected or marginalized areas, and with terms that prioritize access for underserved communities, they can promote equity and reduce socio-economic inequalities.
	Guidelines and criteria for public space design and management				Guidelines and criteria for public space design and management have great potential to enhance biodiversity by increasing habitat areas, improving habitat quality, and supporting connectivity, especially when combined with other instruments. They can boost ecosystem service supply across various contexts, including urban, rural, and peri-urban areas. However, these guidelines could increase costs for public agencies or developers required to comply, and their non-binding nature may hinder implementation if costs are too high or not compensated. Despite these challenges, they improve environmental quality and can enhance accessibility and inclusivity of public spaces, fostering social cohesion. Ultimately, they expand access to quality public spaces for all, contributing to greater socio-economic equality.
	Guidelines for promoting good practices in private spaces				Guidelines for promoting good practices in private spaces have great potential to contribute to biodiversity by enhancing habitat area and quality, as well as improving habitat connectivity, especially when combined with other instruments. They can increase the supply of ecosystem services across urban, rural, and peri-urban contexts. However, the costs of adopting sustainable practices may shift to private landowners, and the non-binding nature of these guidelines may limit their effectiveness if costs are perceived as too high or not compensated. These guidelines can encourage sustainable land management, such as decarbonization through farming practices, and promote equity by involving private actors in conservation. Despite potential resistance from landowners, they can indirectly benefit underprivileged communities by reducing local environmental hazards and fostering stewardship.

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	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1	AMBITION #2	AMBITION #3	SUMMARY OF CONTRIBUTION ANALYSIS
	Biodiversity monitoring & Ecosystems Services Assessments				Biodiversity monitoring & Ecosystems Services Assessments can contribute conditionally to support biodiversity, depending on how they are designed and used to inform decision-making. The effectiveness of these assessments in improving habitat quality and connectivity depends on the choice of ES and condition indicators included. These assessments are only effective when integrated with other SP&MIs. While they provide critical data, they may shift costs to sectors responsible for funding the assessments or managing the land that requires continuous monitoring. The non-binding nature of the instrument could limit its implementation if costs are too high or not compensated. However, if implemented early in planning processes, during plan making, and if it is continuously practiced, biodiversity monitoring and ES assessments can identify critical threats to ecosystems, guiding mitigation strategies to reduce long-term environmental and economic damage. Additionally, monitoring as a function of continuous evaluation, available to spatial planning, should motivate corrective planning actions and deserve broad public disclosure, especially with regard to performance. These assessments raise public awareness of biodiversity issues and support more informed decision-making. When participatory processes and stakeholder engagement are integrated, they can help address inequities in conservation planning, ensuring that the concerns and visions of affected communities are incorporated into the assessment process. This approach promotes more equitable outcomes for communities impacted by environmental degradation.
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	⚠	⚠		Density Bonuses have conditional potential to contribute to biodiversity, mainly by supporting the increase in habitat area if they result in net gains in green space. They can also enhance habitat quality or connectivity, depending on the criteria required and the integration with other SP&MIs. They may also contribute to the supply of ecosystem services (ES), depending on how the requirements are structured. However, this instrument may shift costs to other sectors, particularly by increasing the demographic density in certain urban areas. This could result in added pressure on infrastructure, public services, and environmental resources. In terms of environmental and social costs, density bonuses can encourage higher-density urban development, which helps reduce urban sprawl and preserve surrounding rural or natural landscapes. They can also promote urban equity when bonuses are tied to public benefits (ES supply from GI). However, poorly managed density bonuses could lead to overcrowding or strain on public services, resulting in negative social and environmental outcomes. From a socio-economic perspective, density bonuses can encourage the development of affordable housing options, contributing to a reduction in socio-economic inequalities by increasing access to housing in urban areas. However, this potential may only be realized if the criteria for granting bonuses explicitly include provisions for affordable housing and community welfare.

SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1	AMBITION #2	AMBITION #3	SUMMARY OF CONTRIBUTION ANALYSIS
Transfer of development rights (TDR) mechanisms		⚠		**TDRs** have significant potential to enhance biodiversity and ecosystem services by preserving ecologically valuable lands and increasing habitat area and connectivity. TDRs can also promote recovery and restoration, particularly in urban contexts. However, they may shift costs to developers and landowners in sending areas, potentially limiting their development opportunities. TDRs help preserve sensitive lands and incentivize development in less vulnerable areas, reducing environmental costs. They also provide financial compensation to landowners in sending areas, supporting local communities. However, they can lead to uneven development in receiving areas. In terms of socio-economic impacts, TDRs can redistribute economic benefits to rural or low-income communities by compensating landowners in sending areas, potentially reducing socio-economic inequalities. Proper management is crucial to ensure equitable distribution of benefits and avoid overburdening receiving areas.
Fast-tracking approval process		⚠		**Fast-tracking Approval Process** has conditional potential to contribute to biodiversity and ecosystem services (ES), depending on the type of greening interventions being prioritized. When coupled with other spatial planning and management instruments, it can enhance habitat quality, connectivity, and the overall supply of ES. However, its contribution to habitat area depends on the net increase after considering other developments in the same project. This instrument may reduce costs for developers but could shift administrative and expedited review costs to regulatory agencies. It helps implement sustainable projects faster, reducing delays in achieving environmental benefits. However, it may favor larger developers who can demonstrate broader greening efforts, potentially sidelining smaller or community-led projects. In terms of socio-economic benefits, the fast-tracking process can make development projects more affordable, helping reduce socio-economic inequalities, particularly in sectors like housing. By reducing bureaucratic barriers, it can enable more affordable solutions for underserved communities.
Interim use permits (abandoned/vacant lots)		⚠		Interim Use Permits (Abandoned/Vacant Lots) has potential for biodiversity enhancement by increasing habitat area. If coupled with other instruments, it can improve habitat quality and connectivity, contributing to ecosystem services (ES), particularly in urban areas. This instrument may shift costs to community organizations or temporary users who are responsible for maintaining or enhancing the land during its interim use. Its non-binding nature may limit effectiveness if costs are not compensated. In terms of environmental and social benefits, interim use permits reduce risks associated with abandoned lots, such as illegal dumping, by transforming them into temporary green spaces. These spaces can mitigate urban heat, reduce pollution, and improve safety and aesthetics. However, conflicts may arise over the use of the land and unclear long-term plans for the site. For socio-economic impacts, these permits provide communities with temporary recreational areas or urban gardens, potentially improving local well-being and food security.

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4.3. Key messages

In this chapter we have assessed the transformative potential of substantive SP&MIs based on the assessment criteria defined under BioValue. Our results indicate that most instruments contribute positively to biodiversity, ecosystem services, and socio-economic goals, but this contribution is often conditional on design, implementation, and long-term management. As seen in the previous chapter, most instruments can effectively restore, safeguard or enhance biodiversity by increasing habitat area and/or improving habitat quality, while also potentially supporting ecosystem connectivity if implemented in combination with other planning instruments or under strategic planning. However, our analysis here evidenced that challenges arise when instruments may shift environmental costs to other landscapes or social costs to public budgets, landowners, or smaller stakeholders. For example, *compensation measures* can enhance biodiversity locally, but if poorly implemented, they may displace environmental costs to other landscapes or communities. Similarly, *density bonuses* may increase housing affordability and urban sustainability but risk overburdening infrastructure or creating social inequalities if improperly managed.

A common challenge identified across all instruments is the potential for conflicts over social costs, addressed in *Ambition 2*. For instance, *quantitative standards* and *technological requirements* can impose higher costs on sectors like agriculture or construction, potentially increasing food or housing prices. Similarly, *land use zoning* and *TDR mechanisms* may shift development pressures to less regulated areas or favor wealthier actors, exacerbating socio-economic disparities. Addressing these conflicts requires participatory processes, strategic planning, and combining SP&MIs with other instruments to balance trade-offs, as evidenced in the summaries provided. We highlight the role of participatory approaches in designing SP&MIs, in particular, to help address and eventually mitigate some of these conflicts, by properly identifying actors for equalization of benefits and burdens and aligning expectations.

Frequently, these challenges stem from a perceived absence of political will to implement real transformative policies and actions towards biodiversity protection and enhancement. Public awareness of pressing biodiversity issues is also usually limited, particularly in socioeconomic contexts dominated by other inequalities (poverty, housing, insecurity,...), and society consequently exerts reduced political pressure on governments and institutions in this regard. Ultimately, spatial planning instruments show significant potential to reduce socio-economic inequalities when inclusivity and equity are prioritized in their design and implementation. Various instruments can help create inclusive public spaces, supporting underserved communities and promoting social cohesion. As evidenced in some examples analyzed in Task 1.1 and Task 1.2, *Interim use permits* and *design-based instruments*, in particular, highlight opportunities for rehabilitating urban areas, improving food security, and reducing inequalities by engaging local communities. However, risks such as gentrification, displacement, or uneven distribution of benefits must be carefully managed through participatory governance and equitable decision-making. Overall, the combination of well-designed SP&MIs, strategic integration, and inclusive processes strengthens their transformative potential for biodiversity conservation, environmental responsibility, and socio-economic equity.

Our analysis here focused specifically on SP&MIs, though we acknowledge that the transformative potential of these instruments can be further enhanced in combination with environmental assessment and economic & financial instruments, which will be explored in a future deliverable from BioValue.

5. Future pathways and recommendations for protecting and improving biodiversity in and through SP&MI

In this deliverable, we advance a first in-depth analysis of several substantive SP&MIs with potential to restore, protect and enhance biodiversity. We have analyzed evidence of capacity gaps to their implementation (Chapter 2) and their potential contribution to address several environmental targets (Chapter 3), with a greater focus to biodiversity protection and restoration, both individually and in combination. We have also analyzed opportunities and challenges to address the ambitions for transformative change through these instruments (Chapter 4). In this final chapter, we summarize our results to provide future pathways and recommendations to support the design and implementation of such instruments under a transformative change perspective in spatial planning processes. We also advance a first insight on how each SP&MI could be supported by other instruments (namely environmental assessment and economic & financial), based on our results.

To develop our recommendations, we focus on three critical aspects of spatial planning that determine the effectiveness of plan-making: the calibration, combination, and selection of spatial planning instruments (Stead, 2021). Calibration refers to fine-tuning the severity, timing, and target audience of an instrument, which directly influences the distribution of benefits and burdens (i.e., funding schemes for *design-based instruments* or fines for actors not complying with *regulatory instruments*). This process, however, is shaped not only by economic constraints but also by social norms and governance styles, leading to diverse approaches across different administrations. The combination of tools can generate synergies or conflicts, underlining the need for coherent spatial planning processes anchored within a robust policy strategy. The selection of instruments is often influenced by factors such as path dependence and know-how, where decision-makers tend to prioritize familiar solutions and incremental changes over innovative approaches due to limited resources or perceived risks (Stead, 2021). These decisions are embedded within existing governance structures, which reflect pre-established goals, routines, and institutional preferences (Valler & Phelps, 2018). Therefore, fully understanding the impact of any spatial planning instrument requires a deeper examination of its calibration, historical performance, and integration within its broader policy frameworks. Such an analysis is highly context-specific and lies beyond the scope of this deliverable. For this reason, we limit our recommendation to address the challenges of designing, implementing and managing substantive SP&MIs, and provide guidance on how they can further contribute to safeguard and enhance biodiversity, based on the outcomes presented in this deliverable and trying to address calibration, combination and selection of instruments whenever possible.

Enhancing Habitat Quality and Connectivity through SP&MIs to support biodiversity

Most SP&MIs can directly contribute to increasing the area of natural habitats, but in order to safeguard and enhance biodiversity, increasing natural areas is insufficient, and they need to be implemented together with clear guidelines for habitat quality and connectivity. Coupling SP&MIs with other information-based instruments such as *biodiversity and ES assessments* can help ensure that restoration or preservation efforts meet the desired ecological conditions of the targeted area, effectively contributing to habitat quality. Condition assessments that integrate landscape fragmentation indicators can guide planners in identifying or prioritizing areas for habitat connectivity, particularly when integrated under strategic planning processes. For instance, combining *land-use zoning* instruments with landscape-scale planning provides an opportunity to enhance connectivity and prioritize critical areas for intervention, as evidenced in a few of the practical examples analyzed. Regulatory instruments, like *Quantitative targets* and *qualitative requirements,* should be applied strategically to align with specific biodiversity goals and regional needs. They should be integrated with broader regulatory frameworks and be flexible enough to adapt to different contexts (i.e., enhancing biodiversity in different contexts). The SP&MIs analyzed also have the potential to contribute to broader environmental and climate goals, which should be considered when deciding on and designing SP&MIs. Specific examples of this contribution have been advanced in our analysis.

Addressing Conflicts and Ensuring Equity and Inclusivity

To navigate conflicts arising from vested interests in sectors like agriculture, urban development, and infrastructure, practitioners and decision-makers should promote early and transparent stakeholder engagement in designing SP&MIs. SP&MIs must prioritize inclusivity in their design and implementation to avoid exacerbating socio-economic inequalities. Enforcement instruments such as *expropriation* and *administrative possession* should be applied with caution to avoid potential social conflicts. While these instruments can be effective in safeguarding biodiversity, their implementation may lead to resistance from affected stakeholders or communities. Enforcement instruments that range from pure "expropriation" or "compulsory purchase" to significant restrictions on the land uses (like mandatory "easements") must be considered as SP&MIs that can resolve extreme situations of protection or preservation of unique ecological values or biodiversity, for also extreme situations of total lack of understanding of the amount of compensation to be paid to owners/lessees or affected populations (e.g., when certain agricultural practices are inhibited to preserve certain unique ecological values). Participatory governance processes are essential to identify stakeholders, distribute benefits and burdens fairly, and address potential risks such as gentrification or displacement. Instruments like *interim use permits* and *design-based* interventions have demonstrated potential for urban rehabilitation and potentially supporting underserved communities when local participation is prioritized. For example, involving communities in rehabilitating urban spaces ensures that biodiversity-focused efforts also promote social cohesion and may reduce inequalities. Additionally, given their central role in supporting the design and implementation of other SP&MIs, information-based instruments such as *biodiversity and ES assessments* highly benefit from integrating the principles explored in Task 1.3 (the PIECES for a transformative assessment - Laporta et al., 2023). To this end, *Biodiversity and ES assessment*s should ensure the inclusion of diverse knowledge and conflicting perspectives by promoting meaningful and early stakeholder engagement. It must prioritize feasible methods that align with the goal of transformative spatial planning and encourage integration approaches to identify synergies, trade-offs, and power dynamics among stakeholders. Context-specific information and adaptive co-learning are essential to align local values with transformative change. They should also emphasize methods that clarify potential changes in ecosystem service supply and demand across spatial and temporal scales. Formative interactions among relevant actors are key to fostering mutual understanding and collaboration.

Capacity Building and Institutional Coordination

To address capacity gaps that hinder the effective implementation of SP&MIs, planning authorities must invest in enhancing internal expertise through training programs and recruitment of biodiversity specialists. Building partnerships with academia, as demonstrated through the BioValue project, can provide additional technical expertise and funding opportunities. Encouraging cross-departmental collaboration is essential to overcome siloed decision-making, fostering better integration of biodiversity into land-use planning. Planning authorities should establish dedicated biodiversity units to lead the implementation of SP&MIs and monitor their effectiveness over time, or promote solid collaborations with academic institutions to this end.

Promoting Synergies and Avoiding Trade-Offs

To maximize transformative outcomes, SP&MIs must be combined strategically to avoid trade-offs, such as shifting environmental costs to other landscapes or imposing social costs on vulnerable stakeholders. SP&MIs are not able to address these challenges alone, highly benefiting from support from other instruments (see recommendation below). Regulatory tools, such as *land-use zoning* or *compensation measures*, benefit from being integrated in strategic planning processes and under strong legal frameworks to prioritize biodiversity goals while balancing economic considerations. Post-implementation monitoring is also critical to assess unintended impacts and adapt planning policies accordingly.

Support from other instruments

In line with the instrumental perspective that is central to the BioValue project, based on early interactions with the other WPs focusing on different types of instruments for mainstreaming biodiversity in planning, namely Environmental Assessment Instruments (EAIs) and economic and financial instruments (E&FIs), we engaged in a preliminary exercise to understand how EAIs and E&FIs could support the implementation of SP&MIs and unlock its transformative potential. The results from this preliminary exercise are presented in Table 8, and they will be further explored in future tasks of the BioValue project (namely Task 4.4).

Table 8: Recommendations on how Environmental Assessment Instruments (EAI) and Economic and Financial Instruments (E&FIs) can support SP&MIs and address transformative potential gaps.

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	SUPPORT FROM EAIs	SUPPORT FROM E&FIs
ENFORCEMENT INSTRUMENTS	**Expropriation of land** **Administrative Possession** **Preemption rights**	**Baseline assessment** – to provide basis for implementing the instrument and targeting areas in which to intervene, including landscape fragmentation indicators (to support habitat connectivity) **Tiering –** to support alignment of administrative actions with broader conservation goals, limiting the need to apply enforcement measures to the most pressing issues/areas. **Scenario development/ Alternatives** -to help decide management practices and activities that should be implemented in the targeted area after the instrument is implemented. **Monitoring Evaluation –**to support the maintenance or improvement of the ecological conditions in the targeted area.	Public funding for environmental targets, sponsorships with private agents, and Auctions/Tender calls can be used to secure the necessary financial resources post-implementation.
REGULATORY INSTRUMENTS	**Quantitative targets or standards**	**Baseline assessment -** to make sure quantitative requirements support the desired ecological conditions of the targeted area, protecting and enhancing biodiversity **Monitoring Evaluation –** to ensure the maintenance or improvement of the ecological conditions in the targeted area after implementation	To provide incentives (e.g., tax reliefs) for stewards complying with any new standards introduced or whenever relevant externalities are identified To establish access to credit for stewards to comply with any new standards introduced (e.g., green credits and loans) Negative incentives to penalize polluters - not complying with quantitative targets
	Qualitative and Technological Requirements	**Baseline assessment -** to make sure qualitative requirements support the desired ecological conditions of the targeted area, protecting and enhancing biodiversity. **Monitoring Evaluation –** to ensure the maintenance or improvement of the ecological conditions in the targeted area after implementation, including the effectiveness of adopted technologies	To provide incentives (e.g., tax reliefs) for stewards complying with any new qualitative requirements introduced, whenever externalities are identified. To provide incentives to establish access to credit for stewards to comply with any new technological requirements introduced (e.g., green credits and loans) Negative incentives to penalize polluters - not complying with qualitative requirements
	Compensation measures	***[Compensation measures highly overlap with EAI]*** **Baseline assessment -** to provide basis for implementing the instrument and targeting areas in which to intervene **Mitigation Hierarchy (Offsetting) and Enhancement measures** – to ensure that compensatory actions provide net biodiversity gains **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (both for compliance and for ecosystem recovery)	

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	SUPPORT FROM EAIs	SUPPORT FROM E&FIs
	Performance-based approaches with point systems	**Baseline assessment –** to support the design of the instrument, particularly which natural features should be rewarded given the environmental context of the targeted area **Scenario development / alternatives -** to ensure that the point system is aligned with biodiversity objectives **Monitoring Evaluation -** to track compliance with proposed performance metrics	Potentially provide incentives (e.g., tax reliefs) for stewards complying with the new performance requirements introduced whenever externalities are identified.
	Conservation zones, greenbelts, or protected areas and sites	**Baseline assessment –** to identify key biodiversity areas to intervene, including landscape fragmentation indicators (to support habitat connectivity) **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (both for compliance and for ecosystem recovery)	Potentially provide positive incentives (e.g., tax reliefs) for stewards (i.e., land owners and managers) inside conservation areas, to cover at least the opportunity costs of the restrictions imposed to their activity(ies) but ideally rewarding them fully in line with the benefits provided by their compliant management (e.g., green subsidies, user or provider side PES scheme). Unlocking new markets - Fast-tracking market-based instruments (e.g., certifications and green label initiatives), if applicable. Potentially provide funding via direct contributions from private beneficiaries (e.g., user fees and surcharges) or from corporate sponsorship, if applicable
	Land parcel ownership rearrangements	**Baseline assessment –** to identify key areas in which to intervene for maximizing biodiversity goals **Scenario development / alternatives –** to ensure that the requirements post-implementation are aligned with biodiversity objectives (i.e., which activities will be **Cumulative assessments –** to evaluate regional ecological effects of the rearrangement (and respective changes in land-use management) **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (both for compliance and for ecosystem recovery)	Potentially provide incentives (e.g., tax reliefs) for stewards (i.e., landowners and managers) willing to engage in land readjustment. Stewards should be compensated at least for the opportunity costs of the restrictions imposed to their activity(ies) as a result of the readjustment, but ideally should be rewarded fully in line with the benefits provided (e.g., green subsidies, user or provider side PES scheme). Unlocking new markets – Fast-tracking market-based instruments (e.g., certifications and green label initiatives), if applicable. Fast-tracking access to sectoral funds that support compliance with best practices (forestry, agriculture), for stewards engaging in land readjustment, if applicable.
	Land use zoning schemes in urban or rural spaces at different scales	**Baseline assessment -** to provide basis for implementing the instrument and targeting areas in which to intervene, including landscape fragmentation indicators (to support habitat connectivity) **Scenario development –** may support deciding on the best zoning schemes to implement based on potential environmental and social impacts	Negative incentives to penalize polluters - not complying with zoning requirements Environmental Taxes to support the monitoring of zoning restrictions.

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	SUPPORT FROM EAIs	SUPPORT FROM E&FIs
		Cumulative assessments - to ensure that zoning contributes to regional biodiversity goals and avoid negative impacts outside of the city's jurisdiction	
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**	**Baseline assessment** - to provide basis for implementing the instrument and targeting areas in which to intervene, including landscape fragmentation indicators (to support habitat connectivity) **Tiering** - to ensure that project-based designs align with higher-level biodiversity objectives. **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (both for compliance and for ecosystem recovery)	Provide positive incentives (e.g., increased access to municipal funding redistribution) to public entities engaging in such programs. Corporate sponsorship can also play a role. This can be coupled with qualitative requirements or quantitative targets to determine different thresholds for accessing more (or less) municipal funding (i.e., municipalities implementing certain types of design-based instruments and/or covering a specific % of targeted habitats can be eligible to additional funding)
	Land acquisition	**Baseline assessment –** to provide basis for implementing the instrument and prioritize areas in which to intervene, including landscape fragmentation indicators (to support habitat connectivity) **Tiering –** to support alignment of administrative actions with broader biodiversity goals, limiting acquisition to the most pressing issues/areas. Scenario development/ Alternatives -to help decide management practices and activities that should be implemented in the targeted area after the instrument is implemented. **Monitoring Evaluation –** to support the maintenance or improvement of the ecological conditions in the targeted area.	Provide positive incentives (e.g., increased access to municipal funding redistribution) to public entities engaging in such programs. Corporate sponsorship can also play a role. This can be coupled with performance-based instruments to determine different thresholds for accessing more (or less) municipal funding.
	Contractualizations, Partnerships and Stewardships, including Conservation Easements	**Baseline assessment –** to provide basis for implementing the instrument, prioritize areas in which to intervene, and help define the ecological conditions to be maintained or achieved through contractualization **Tiering –** to ensure that project-based contractualization and conservation easements (and its respective requirements) align with higher-level biodiversity objectives. **Monitoring Evaluation –**to support the maintenance or improvement of the ecological conditions in the targeted area.	***[Contractualization highly overlap with E&FIs]*** It could be further supported by other E&FIs if developers are willing to comply with *Guidelines for promoting good practices in private spaces*, as explained in the respective SP&MI above.
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**	**Tiering –** to ensure that the guidelines align with broader conservation plans and targets **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (checking both for compliance and biodiversity enhancement)	Provide positive incentives (e.g., increased access to municipal funding redistribution) to public entities complying with the guidelines. Corporate sponsorship can also play a role. This can be coupled with performance-based instruments to determine different thresholds for accessing more (or less) municipal funding.
	Guidelines for promoting good practices in private spaces	**Tiering –** to ensure that the guidelines align with broader conservation plans and targets **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (checking both for compliance and biodiversity enhancement)	Provide positive incentives for stewards (i.e., landowners and managers) willing to incorporate best practices. Potential types of positive incentives include primarily public funding sources (PES schemes, green subsidies), establishing access to credits (green investment facilities, green credits

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	SUPPORT FROM EAIs	SUPPORT FROM E&FIs
			and loans), corporate sponsorship, and, if applicable, unlocking new markets (certification, eco-labelling, eco-tourism) Stewards should be compensated at least for the opportunity costs of any restrictions imposed to their activities but ideally should be rewarded fully in line with the benefits provided by the adoption of good practices.
	Biodiversity monitoring & Ecosystems Services Assessments	***[Biodiversity Monitoring and Assessments highly overlap with EAI]*** **Baseline assessment –** to provide basis for implementing the instrument **Process timing –** to ensure assessments inform spatial planning decisions in feasible time.	
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	**Scenario development -** to help understand potential ecological trade-offs resulting from increased density. **Mitigation hierarchy –** to ensures bonuses address biodiversity impacts. **Monitoring Evaluation –** to ensure that habitat quality and connectivity is maintained post-implementation (checking both for compliance and biodiversity enhancement)	***[highly overlap with E&FIs as a form of incentives for private agents]*** It could be further supported by other E&FIs such as incentives to establish access to credit (green credits and loans) for developers striving to meet the required criteria, and/or developers that are willing to comply with *Guidelines for promoting good practices in private spaces*, as explained in the respective SP&MI above.
	Transfer of development rights (TDR) mechanisms	**Baseline assessment –** to provide basis for implementing the instrument, prioritize areas in which to intervene, and help define the ecological conditions to be maintained or achieved in sending areas **Cumulative assessments -** to ensure TDRs contribute to biodiversity conservation across landscapes. **Monitoring Evaluation –** to ensure that habitat quality is maintained post-implementation (checking both for compliance and biodiversity enhancement)	***[highly overlap with E&FIs as a form of incentives for private agents]*** It could be further supported by other E&FIs if developers are willing to comply with *Guidelines for promoting good practices in private spaces*, as explained in the respective SP&MI above.
	Fast-tracking approval process	**Process timing -** to ensures accelerated approvals still meet biodiversity assessment criteria. **Mitigation Hierarchy (Offsetting) and Enhancement measures –** to ensure that approved projects provide net biodiversity gains **Monitoring Evaluation –** to ensure that habitat quality is maintained post-implementation (checking both for compliance and biodiversity enhancement)	***[highly overlap with E&FIs as a form of incentives for private agents]*** This SP&MIs is in itself a form of positive incentive for private agents. This It could be further supported by other E&FIs if developers are willing to comply with *Guidelines for promoting good practices in private spaces*, as explained in the respective SP&MI above.
	Interim use permits (abandoned/vacant lots)	**Baseline assessments –** to help identify biodiversity potential of vacant lots. **Monitoring Evaluation –** to ensure that habitat quality is maintained post-implementation (checking both for compliance and biodiversity enhancement)	***[highly overlap with E&FIs as a form of incentives for private agents]*** It could be further supported by other E&FIs if developers are willing to comply with *Guidelines for promoting good practices in private spaces*, as explained in the respective SP&MI above.

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7. Annexes

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A. LIST OF SP&MIs INSTRUMENTS

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
REGULATION-BASED INSTRUMENTS	**Quantitative targets or standards**	Definition of quantitative requirements, targets or standards that must be met when developing or redeveloping an area. This includes developer's obligations such as dedication requirements to set aside a portion (%) of land for specific public purposes (typically local public facilities or infrastructure in urban contexts). Can be implemented with equalization of benefits & burdens.	**From T1.1 (included in spatial plans at different planning levels)** ● Mandatory limitation of impermeable surface expansion through urban regeneration and land reuse to reduce soil consumption (Bologna Urban Plan) ● Quantitative standards for public greenery were introduced to enhance phytomass and urban drainage in public buildings (Bologna Urban Plan) ● Targets to increase tree canopy cover in cities (%), improving green spaces in urban areas, and supporting community-led local place plans. (Scotland Land-use Framework) ● Incorporating bioclimatic criteria into land use and building regulations at lower planning scales. (Basque Country Regional Plan) **From T1.2 (best-practices)** ● No net land taken by 2050 (EU level) ● National Strategies for 'Land Saving' and 'Targets for Reducing Land Use' within the German Sustainable Development Strategy (Germany) ● 'Environmental Rural Registry' (CAR): Brazilian legal framework for registration of rural properties (Brazl), which requires a % of rural properties to be kept by native ecosystems under certain classifications ● **From the literature** ● (Unsealed) open space requirements, such as share or amount of pervious/ green areas to maintain or include in the property areas (e.g., several municipalities in Italy) (Cortinovis & Geneletti, 2018) ● A minimum volume of stormwater to retain and manage on-site in the property area (e.g., Toronto, Canada) (Johns et al. 2018) ● Minimum plant size (e.g., height, trunk diameter) for newly planted vegetation (e.g., City of Auburn, US) (Zhang et al. 2009)
	Qualitative and Technological Requirements	Definition of qualitative elements or technologies that must be included when developing or redeveloping an area. This includes developer's obligations and can be implemented with equalization of benefits & burdens.	**From T1.1 (included in spatial plans at different planning levels)** ● Mandatory installation of green roofs on specific developments – commercial and industrial (Bologna Urban Plan) ● Mandatory incorporation of multifunctional open spaces in appropriate quality and quantity and of Sustainable Drainage Schemes (SuDS) in new developments, that should be integrated as part of the overall landscape framework for the development, designed to enhance habitats for wildlife. These open spaces should also provide green infrastructure to connect with wider blue/green networks. (Cairngorms Park Plan 2020)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
			● Implementing green roofs and green walls on all municipal public buildings. (Setubal Municipal Plan) ● Green provisions for new structures and the conservation of phytomass in requalification projects, with added protection for monumental trees and river environments. (Bologna Urban Plan) **From the literature** ● Mandatory installation of on-site stormwater management measures offering the opportunity to install NbS for rainwater management (e.g., Berlin, Germany) (Naumann et al. 2020) ● Mandatory tree/vegetation planting in housing gardens (e.g., one municipality in Brimbank City Council, Australia) (Furlong et al. 2018)
	Compensation measures	Definition of mandatory ecological compensation actions that must be realized when developing or redeveloping an area.	**From T1.1 (included in spatial plans at different planning levels)** ● Landscape parks are built for compensating adverse impacts of development on the environment. E.g., 1) new landscape parks in the Barnim area will provide room for outdoor leisure and ecological mitigation; 2) the Gleisdreieck park was realized as a compensation measure and provides green open spaces. (Berlin Metropolitan Plan) ● As part of the landscaping, nature protection and nature improvement is incorporated. Specifically, if waterholes/ponds are destroyed, replacements in the form of ponds or lakes should be created in the local area. (Skive Municipal Plan) ● Restoring private tree areas after demolition. (Bologna Urban Plan) **From the literature** ● Mandatory land property transfers to retain open space and/or realize public greenery to compensate for environmental impacts occurred elsewhere (e.g., several municipalities in Italy (Cortinovis & Geneletti, 2018)) ● Off-site compensation schemes (e.g., mitigation banking) for developing nature-based off-site measures in situations where on-site implementation is cost-prohibitive or not feasible (e.g., several municipalities in North America (Cousins & Hill, 2021) ● (Monetary) compensation for tree removal/damages by developers (e.g., Melbourne, Australia). Fees are then used to directly realize or finance NbS. (Bush & Hes 2018)
	Performance-based approaches with point systems	Definition of a minimum performance score that must be gained by attaining defined levels of green and blue surfaces when developing or redeveloping an area.	**From T1.1 (included in spatial plans at different planning levels)** ● RIE Index (Bologna Plan) **From the literature** ● Performance-based green area indicators and point systems setting minimum green coverage requirements (achieved through retaining the existing and integrating new green spaces), also called green factor tools or green area factors, among others (e.g., Oslo, Norway) (Kronenberg et al 2021)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
	Conservation zones, greenbelts, or protected areas and sites	Identification of specific sites or green elements to be preserved and definition of restrictions to their use and transformation, usually under existing and binding regulatory frameworks for development or under ad-hoc regulatory framework	**From T1.1 (included in spatial plans at different planning levels)** ● Urban rejuvenation initiatives, including the establishment of ecological equilibrium zones, wooded corridors, and the reclamation of brownfield sites for naturalizing and restoring ecosystem functions. These zones make up the Ecological Networks Map integrates protective strips, connectivity corridors, gateways, and cycling routes (Bologna Urban Plan) ● Regional planning regulations that mandate municipal or inter-municipal planning for vacant spaces, envisioning park and forest areas for leisure, barring soil sealing (Emilia Romagna Regional Plan) ● Establishment of ecological networks or corridors in protected areas, potential nature areas, ecological connections, potential ecological connections, rivers and streams. Construction and building cannot be allowed in these networks if it deteriorates the nature values, including the possibilities for new or extended ecological connections. (Copenhagen Plan) ● Preserving and creating green spaces and trees, mainly for cold air production and health reasons. Explicitly mentioned: preservation of flora and fauna of urban meadows (Tempelhofer Feld) (Berlin Metropolitan Plan). ● Structuring corridors within the Metropolitan Ecologic Structure as essential for facilitating exchanges between ecosystems. These corridors play a crucial role in ensuring connectivity between ecological systems, particularly for fauna (Setubal Municipal Plan) ● Classifying valuable headwater zones and related watersheds as protected areas (Basque Country Regional Plan) **From T1.2 (best-practices)** ● Green Corridors (Lisbon, Alcântara) **From the literature** ● Tree protection regulatory schemes (e.g., tree protection ordinances) as a standalone city law or enforced in city zoning regulations (e.g., Seattle, US) (Ordonez-Bardona et al. 2021) ● ·Definition of a (zoning) boundary for a protected area (e.g., urban natural park area, significant biotopes) together with the rules setting restrictions and limitations (e.g., Berlin, Germany) (Fischer et al. 2013
	Land parcel ownership rearrangements	Land parcel ownership rearrangements involve a planned readjustment of land parcel boundaries, sizes, or ownership. These processes aim to improve land use efficiency, align with broader spatial and environmental policies, and ensure an equitable distribution of the benefits and	**From T1.3 (ES assessment framework implemented in the Arenas)** ● Flubereinigung ("Land Reassembly") as explored in the Mecklenburg-Vorpommern Arena) **From the literature** ● Cluster zoning to allow for wider open space preservation (e.g., several municipalities in the US) (Milder & Clark 2011)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
		burdens resulting from spatial and environmental policies between landowners and the community (such as those associated with biodiversity promotion). In urban and peri-urban contexts, land readjustment (LR) is predominantly applied, whereas land consolidation is used in rural areas. These readjustments can involve voluntary agreements between private landowners, though they are often instigated or enforced by the government. Key mechanisms include voluntary land swaps (ensuring fair compensation and treatment between landowners), land dedication requirements, economic and financial compensations, and expropriation. Can be implemented with equalization of benefits & burdens for adequate equity and compensation.	
	Land use zoning schemes in urban or rural spaces at different scales	Land use zoning schemes in urban or rural spaces at different scales. Includes the definition of permitted and forbidden uses/management activities related to specific land uses. Widely used land use plans for cities, municipalities or rural areas, typically ranging from 1/10.000 to 1/100.000 geographic scales, often have significant impacts on the organization of different land uses and major infrastructures on the territory.	**From T1.1 (included in spatial plans at different planning levels)** ● Creation of spatial systems with recreational, productive, and protective functions under a Municipal Ecological Structure and Urban Ecological Structure (Setubal Municipal Plan) ● Six categories to regulate non-developable land include special protection, environmental improvement, superficial water bodies protection, etc. Rivers, streams, lakes, and water reservoirs should be cataloged as non-developable land. (Basque Country Regional Planning) **From the literature** ● Definition of permitted and forbidden uses/management activities related to specific land uses, especially in non-urbanized land (e.g., several municipalities in Italy) (Cortinovis & Geneletti, 2018)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
	Other instruments related to zoning regulations	Other instruments related to zoning regulations	**From T1.1 (included in spatial plans at different planning levels)** ● Innovative use of particular areas, like a complex area systems for proactive climate change adaptation (Emilia Romagna Regional Plan) **From the literature** ● Special overlay zones (or districts) to enforce protection of sensitive natural areas/vegetation (e.g., Tucson, US) (Derksen et al. 1997)
ENFORCEMENT	**Expropriation of land**	Expropriation is the government's legal tool for acquiring private land for public interest uses (urban development, infrastructure, and public utilities), often following the formal declaration of public interest, with compensation provided to the landowner.	**From the literature** ● Expropriation and other state-driven territorial policies in the Pyrenees have shaped current conservation efforts and protected areas (Vaccaro, 2005) ● In the Netherlands compulsory purchase helps to define the relationships between local authorities and private players in a planning context - W. K. Korthals Altes (2014) ● provinces implementing national policies on biodiversity conservation may acquire a maximum of 10% of the area necessary using compulsory purchase in the Netherlands (F.M. Van Straalen et al. 2014))
	Administrative Possession	Administrative possession is a legal tool that enables the administration to take possession temporarily to do what the owner should have done and did not do. The return is then made with charges.	
	Preemption rights	The right of preference exerted by public entities which allows the administration to override a deal between individuals in order to acquire a given good for the same value.	
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**	Definition of specific design solutions and regulations to apply to a specific development area, which are formalized in a (master)plan that identifies the approximate location, typology, and size of the main elements over the entire project. They can be part of execution or implementation programs.	**From T1.1 (included in spatial plans at different planning levels)** Landscape parks designed on a local project basis as part of the Berlin green strategy (Berlin Metropolitan Plan) ● "A dedicated Action Program for the Environment is in place, along with numerous projects to improve urban public spaces and create reference green zones for ● recreation and leisure." (Lisbon Municipal Plan) ● The Dundee Waterfront aims to create a resilient waterfront regeneration, providing a high-quality, mixed- use, and locally liveable place that addresses climate impacts. (Scotland National Plan)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
			• Creation of the "Water Route," linking Setúbal city through a pedestrian pathway establish a route enriched with open green spaces, seating, and recreational zones. • Pilot projects with NatureScot, Architecture & Design Scotland, and the Scottish Federation of Housing Associations aim to integrate green infrastructure into social housing developments for climate change mitigation through features like green roofs and rain gardens. **From Task 1.2 (best-practices)** • The Green Belt in Victoria Gasteiz (Spain) - The Green Belt is a collection of projects, each with its own financing arrangements. The city's government covers up most of the costs, while financial compensations are shared (43% coming from EU structural funds, 26% from the Spanish Government, and 31% from the Basque Government. • "Healthy Corridors" provided through URBiNAT (Urban Innovative and Inclusive Nature) consortium (Oporto, Portugal) – regenerating social neighborhoods • Guelph City Pollination Park **From Task 1.3 (Arenas)** • Requalification project of the Fersina-Sale portion (Trento, Italy) **From the literature** • Masterplan/detailed action plan indicating the location and typology of permitted building, infrastructure, and green/blue space development (e.g., Bradford, US)
	Land acquisition	The public administration (e.g., municipality) buys the land from the owners to prevent development or to realize public (green) projects (also called "fee simple" acquisition programs).	**From T1.1 (included in spatial plans at different planning levels)** • The plan encourages municipalities to acquire areas required for the Metropolitan Ecologic Structure. These areas can become part of municipal heritage. The aim is to ensure their public use through acquisition or agreements with owners. These actions should help address border and termination issues between urban areas and facilities for structural coherence. (Lisbon Metropolitan Plan) **From the literature** • Land acquisition for realizing urban parks or other public NbS (e.g.,Krakow, Poland) • Land acquisition for preserving from development, restoring, and protecting environmentally sensitive non-urbanized land (e.g., Boulder, US)
	Contractualizations, Partnerships and Stewardships, including Conservation Easements	Widely used tools where the (local) administration can assume different roles (regulator, coordinator/ leadership, imposition) in the contractualization of territorial development for specific purposes. This can include contractual partnerships between public institutions, between private and public institutions, as well as stewardship/sponsorship agreements for the	**From T1.1 (included in spatial plans at different planning levels)** • Contractual arrangements with private owners for nature conservation in the restricted Park areas (Arrabida Natural Park Plan) **From T1.2 (best-practices)** • Friends of Portbury Wharf (England) – private management partnership in a RAMSAR wetland **From the literature** • Sponsored pedestrian paths (Scotland)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
		maintenance or development of specific areas. It also includes legal agreements placed on a piece of property to restrict the development, management, or use of the land, known as Conservation Easements, which involves the voluntary selling or gifting of one or more of rights (e.g., occupy, use, lease, sell, and develop the land, as well as harvest the vegetation and minerals on it) from the land owner to a public agency or organization, for a specific (conservation) purpose	
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**	Guidance documents providing design guidelines and/or criteria that should be applied when realizing and/or managing public spaces. This includes provisions from higher planning levels and other sectors.	**From T1.1 (included in spatial plans at different planning levels)** ● Municipal guidelines for the creation of ecological structures and green infrastructure, nature conservation and landscape enhancement, and in particular, mechanisms for valuing ecosystem services. (Portuguese National Planning Programme) ● "All developments must be located in areas free from medium to high flood risk, considering the predicted impacts of climate change. It should not increase flooding risk elsewhere, add to flood prevention requirements, or hinder the functional floodplain's ability to store or redirect ● floodwaters." (Cairngorms Park Plan 2020) ● Local Development Plans (LDPs) should consider incorporating green belts as a settlement management tool to limit development around towns and cities. Nature-based solutions should be utilized wherever possible to manage future coastal changes and build strength to climate change effects, incorporating blue and green infrastructure and nature-rich habitats. (Scotland National Plan) ● Regional Planning Guidelines for the Basque Country **From T1.2 (best-practices)** ● DOTSE. Directrices de Ordenación de Ámbito Supraregional de Segovia y Entorno ● ESPON-SUPER (Sustainable Urbanization and land-use Practices in European Regions) (EU level)
	Guidelines for promoting good practices in private spaces	Guidance documents and manuals providing information on (nature-based) principles, best practices, and techniques to apply in private areas.	**From T1.1 (included in spatial plans at different planning levels)** ● All developments must be located in areas free from medium to high flood risk, considering the predicted impacts of climate change. It should not increase flooding risk elsewhere, add to flood prevention requirements, or hinder the functional floodplain's ability to store or redirect floodwaters. (Cairngorms Park Plan 2020) **From T1.2 (best-practices)** ● Bristol Good Food 2030 (guidelines on farming practices and land-use)

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
			From T1.3 (Arenas) ● Hospital Development Recommendations for the tender call regarding Fersina requalification/NbS solutions (Trento Municipality)
	Biodiversity monitoring & Ecosystems Services Assessments	Biodiversity databases, indexes and indicators, including monitoring systems and assessment of ecosystem condition and Ecosystem Services.	**From T1.1 (included in spatial plans at different planning levels)** ● A qualitative analysis of ecosystem services in urban and rural areas to identify the right strategies, actions and rules to conserve and implement citizens' benefits (Urban Plan Bologna) ● Regional recommendations to integrate suitable indicators for the mapping and assessing ES that can detect a decline or improvement in the supply trend in local plans (Basque Country Regional Plan) ● The Plan integrated the information on ES and indicators of environmental quality, such as water quality, biodiversity, and soil permeability, developed by the Centre of Environmental Studies of Vittoria (General Urban Development Plan Vittoria Gasteiz) **From T1.2 (best-practices)** ● Biodivercities project (Portugal) ● BIODIVERSITY MONITOR – Towards a Biodiversity Monitor for Dairy Farming ● The Toolkit for Ecosystem Service Site-based Assessment - TESSA
	Other information-based instruments	Other instruments aimed at supporting biodiversity enhancement/protection and green space planning activities by providing relevant information and knowledge, including monitoring tools	**From T1.1 (included in spatial plans at different planning levels)** ● Identifying and proposing forestry and woodlands around urban settlements to provide multiple benefits and enhance climate resilience. (Scotland National Plan) ● Interference quantification used to shape spatial scenarios, focusing on mitigating land fragmentation in the implementation of the local plans (Emilia Romagna Regional Plan)
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	Increase in the floor area/building volume allowed in the site in exchange for meeting certain criteria.	**From T1.1 (included in spatial plans at different planning levels)** ● Allow developments exceeding the residential capacity index whenever they constitute an urban re-densification or regeneration intervention (Guidelines for Regional Planning, Basque Country) ●
	Transfer of development rights (TDR) mechanisms	Giving rights to build in another area or to sell the development rights in exchange for the preservation from development (through a conservation easement) of the original area. Can be implemented with equalization of benefits & burdens to free-up space for biodiversity, functioning like a compensation scheme.	**From T1.1 (included in spatial plans at different planning levels)** ● TDR Programmes (Fondo Perequativo Metropolitano) in Bologna Plan (Bologna Plan) ● Transferring development rights (TDR) attributed to a lot or plot of land to other lots or parcels was created in this law, namely for purposes related to the Conservation of Nature and Biodiversity" (Portuguese General Urbanism Law) ● In the Lauka neighborhood, the Plan transfers development rights to vacant lots (Vittoria-Gasteiz Plan) **From the literature**

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	DEFINITION	A FEW EXAMPLES FOUND IN WP1
			● TDR programs for preserving natural/agricultural land from development (e.g., several municipalities in Italy) (Cortinovis & Geneletti, 2018)
	Fast-tracking approval process	Fast-tracking of approvals (or expedited/agile permitting processes) for projects that incorporate greening interventions, ideally associated with its respective management plan.	**From T1.1 (included in spatial plans at different planning levels)** ● Facilitating administrative simplification through standardized language and rules while enhancing citizen engagement via co-design processes. (Bologna Plan)
	Interim use permits (abandoned/vacant lots)	Temporary activation of vacant and/or underutilized land for a defined period of time, under specific terms defined within a temporary use permit issued by local authorities. Here only permits for garden/urban agricultural purposes or for recreational uses with blue/green infrastructures are considered.	**From T1.1 (included in spatial plans at different planning levels)** ● Intervention in nature areas of low quality can be permitted if the means improved living conditions for natural animals and plants. (Copenhagen Plan) ● Development Exaction for public space or other collective uses and the possibility to incorporate rural plot without known owner, nor use, to the national land repository. This action provides non-built areas for implementing actions that directly or indirectly improve biodiversity. (Portuguese General Urbanism Law) **From T1.2 (best-practices)** ● The old railway track circuit in New York (The High Line) ● The Greenwich Millenium Village (London)

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B. CAPACITY GAPS FOR THE IMPLEMENTATION OF SPATIAL PLANNING INSTRUMENTS FOR CLIMATE CHANGE AND ENERGY TRANSITIONS.

From IN-PLAN Project Deliverable D2.2 (Forstinger et al., 2023).

GAP TYPE	IDENTIFIED GAPS	BRIEF DESCRIPTION
Personnel and Financial Resources	**Lack of (qualified) personnel within local administrations responsible for spatial planning**	Smaller municipalities often lack specialized staff in areas like spatial planning, climate mitigation, and mobility, frequently relying on external planners for spatial plans, with some subcontracting all planning tasks. Limited staffing and expertise make it challenging for these municipalities to take on additional responsibilities, as existing staff face significant time constraints
	Lack of financial resources	Financial resources play a crucial role in shaping the scope and effectiveness of spatial planning processes. Limited funding can restrict the involvement of experienced participants, hinder adequate public participation, and constrain the implementation of planned measures, such as public infrastructure projects. To support effective spatial planning, dedicated budgets and innovative financing mechanisms are essential, particularly for enabling a successful green transition.
Knowledge & Expertise (internal & external)	**Lack of knowledge to counter certain interests**	Even with own staff assigned for spatial, energy and mobility planning, there is often still a gap in knowledge, especially when it comes to "new" issues, technologies and trends. This lack of knowledge can often lead to weak and/or inadequate responses towards advocacy groups, pushing towards meeting certain interests that might not necessarily be in the public's interest.
	Lack of data available	Basic research is vital in spatial planning, providing the foundation for justified, context-specific decisions and aiding in legal defense when necessary. Comprehensive local analysis supported by specific data is crucial for understanding issues, leveraging existing capacities, and setting tailored objectives. However, gaps in data on emissions, energy use, renovations, and mobility, as well as challenges in data sharing due to legal or other barriers, often hinder progress. Establishing a shared data repository with clear methods for collection, storage, and updates can prevent data loss, duplication, and misinterpretation, supporting a more integrated planning process.
	Lack of know-how regarding existing planning tools & instruments	Innovative planning-support tools, including urban energy maps, environmental maps, and climate maps, offer significant potential to enhance resource efficiency and decision-making in spatial planning. These tools facilitate data collection, visualization, and the modeling of urban systems, such as mobility and energy consumption, helping stakeholders comprehend and justify necessary measures. However, their effectiveness is often undermined by a lack of knowledge or training on how to use these tools and fully leverage their capabilities, leaving much of their potential unrealized.
	Lack of expertise with external consultants/planning offices	Most survey participants indicated reliance on external planners for drafting spatial plans, meaning the inclusion of climate and energy considerations in these plans often depends on the expertise of these external planners. Since planning offices must adhere to the municipality's requirements, it is crucial to provide a well-founded argument to highlight the importance of integrating climate and energy aspects. Workshop discussions suggested that tender documents could serve as a strategic opportunity to mandate specific knowledge and expertise from external experts, ensuring that these critical factors are considered in the planning process.
Legislative Framework	**Lack of supporting legal framework conditions**	In most cases, there is no legal requirement to incorporate climate and energy considerations into spatial planning, and such integration is typically voluntary. An appropriate legal framework could significantly enhance municipalities' ability to make spatially differentiated decisions. Currently, some aspects are excluded from spatial planning due to the lack of legal mandates, such as addressing the building stock or implementing energy-efficient regulations. Most cities also have limited legal authority to modify laws governing spatial planning. While certain issues, such as e-mobility charging stations, air pollution, building refurbishment, and climate adaptation, are already addressed in spatial plans, renewable energy production and infrastructure planning are often insufficiently integrated. Spatial planning

GAP TYPE	IDENTIFIED GAPS	BRIEF DESCRIPTION
		laws often lack the necessary provisions to support energy goals based on spatial differentiation, limiting the inclusion of energy aspects in planning processes.
	Unambitious implementation of laws and strategies: legal potential that remains unused	In most cases, a complex legal hierarchy governs spatial planning, outlining the mandates, objectives, and possibilities for different levels of planning. However, these legal instruments are often underutilized due to a lack of knowledge or political will. For example, despite a supportive legal framework, only a few municipalities in Styria, Austria, develop energy concepts, even though such frameworks enable the definition of settlement expansion areas and the designation of zones for renewable energy production. Additionally, while a clearly defined planning framework that outlines roles, responsibilities, and steps can foster integrated planning, the lack of clarity on how to ensure vertical coherence often leads to inconsistent objectives, measures, and misaligned planning tools.
Governance & Processes	**Lack of clear overarching long-term strategies on how to achieve biodiversity enhancement**	Having an overall long-term strategy on how to achieve climate neutrality can help steer municipal/urban development and planning in a clear and timely-coordinated manner. Based on such a strategy, measures and actions as well as key levers can be identified and prioritized.
	Lacking coherence and consistency between different strategies	Most participating municipalities and counties can already draw on distinguished and well-elaborated national, regional /or local strategies and other strategic documents. However, outcomes, measures and actions set out in these documents often do not find their way into spatial plans. During the workshops with the lighthouses, a clear need for help in integrating existing strategies and documents with spatial plans was mentioned.
	Lack of horizontal cooperation (within municipal departments): Thinking and working in silos	In municipalities, especially larger ones, climate change mitigation, adaptation, mobility, and energy issues are often managed by separate specialized departments, leading to siloed thinking. This lack of coordination can result in disconnected action plans and sometimes even conflicting goals between departments. To address this, it is crucial to clearly define responsibilities while fostering collaboration and cooperation between departments. Establishing flexible, interdisciplinary working groups with representatives from various departments can help facilitate targeted discussions and overcome siloed approaches, ensuring more integrated and cohesive spatial planning.
	Lack of vertical cooperation (between administrative levels)	Spatial planning within a country is usually characterized by a strong hierarchical system, with different levels having different competences and tasks. Higher-level entities, with a larger area of consideration, oftentimes take on a different position regarding spatial planning due to their different perspective (the supra-regional interests in focus). Thus, good coordination and communication between the individual levels can significantly benefit the implementation of ambitious climate and energy targets in spatial planning.
	Thinking solely within one's own administrative borders	Currently, spatial planning typically stops at municipal boundaries, with settlement developments not being coordinated with those in neighboring municipalities. However, in areas like energy and mobility, cross-municipal collaboration would be beneficial for managing commuter flows, guiding settlement development, expanding public transport, and optimizing resource allocation. To address this, some communities, often with support from evolving regulatory frameworks, are advocating for a metropolitan approach that extends spatial planning beyond single municipalities to include a broader, more integrated regional area.
	No monitoring to ensure adequate implementation	In many cases, the implementation of spatial plan requirements is not reviewed after adoption, which can prevent the original, ambitious goals from being realized. The absence of long-term enforcement and monitoring may undermine the effectiveness of spatial plans. To address this, it is recommended that stakeholder engagement be a continuous and adaptable process throughout the entire planning cycle—encompassing planning, evaluation, implementation, and post-implementation monitoring.

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GAP TYPE	IDENTIFIED GAPS	BRIEF DESCRIPTION
Awareness & Political will	**No common vision on future targets**	Oftentimes policy makers (but also other relevant stakeholders) lack a basic understanding of the territorial systems, their interrelations, and a common vision for the long-term objective. This is, however, key to secure political support, to push local action and to guarantee political commitment necessary to mobilise resources to implement plans and to foster synergies among ongoing actions. A lack of a unanimous opinion on the political level on how to move forward on certain issues creates the risk that spatial plans lack in ambition or are watered down due to compromises.
	Lack of political support, will and/or ambition	Political decisions often involve compromises, as various needs and objectives must be balanced. In the survey, only one municipality cited a lack of political will as a major obstacle to integrating climate and energy aspects into spatial planning, while two municipalities disagreed entirely. However, workshops frequently highlighted that a lack of political will, particularly in mobility issues, limits the extent of climate and energy ambition in spatial planning. Active political support is crucial for facilitating both vertical and horizontal cooperation.
	Lack of public awareness/public acceptance	Some municipalities stated that they are currently faced with either still low awareness or even (strong) opposition for environmental and energy issues (i.e. against PV and wind energy), and/or low participation within the population. Here, a participatory process allow for different viewpoints on needs and interests of citizens and other stakeholders to be considered and could help in generating awareness and support for certain actions and measures. A bottom-up approach strongly including local stakeholders can bring forward solutions also citizens can accept and support during the implementation phase.
	Lack of engagement of certain stakeholders and citizens	Further incorporating energy and climate aspects into spatial planning may require coordination with more stakeholders. Cooperation and coordination with utilities, network operators (DSOs), private companies and even citizens, etc. is often not yet common in some municipalities. Often, municipalities also encounter difficulties cooperating with these stakeholders due to existing certain interests. In general, involving relevant stakeholders from the beginning of the planning process is considered essential. It can help to counteract early resistance.

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C. CAPACITY NEEDS FOR ADDRESSING BIODIVERSITY ISSUES AT THE SCIENCE-POLICY-SOCIETY INTERFACE.

From BioAgora Project Deliverable 5.1 (Czett et al., 2024).

CAPACITY NEEDS (THEMES)	BRIEF DESCRIPTION
ELIMINATING RESEARCH GAPS	The 'Eliminating research gaps' category refers to the need to cover necessary research topics and eliminate difficulties arising from a lack in research. It encompasses a range of challenges that hinder the seamless integration of research into effective policymaking.
KNOWLEDDGE & DATA HUB	The category 'Knowledge and data hub' refers to the need to overcome challenges arising from the dispersed and fragmented nature of knowledge and data. This category refers to various issues that underscore the need for improved coordination, integration, and accessibility to ensure that scientific and other domains of knowledge effectively inform decisions.
PERSONAL TIME MANAGEMENT	According to interviews, a major constraint to effective science-policy interactions is the scarcity of time, not just at the side of policymaking, but also in science and practice. Lack of time negatively influences engagement and collaboration, and it makes knowledge synthesis and co-production more challenging.
POLICY LITERACY	The capacity need associated with policy literacy refers to deficiencies in understanding the policy landscape. This gap is more prevalent for scientific actors than societal actors or practitioners. Several different aspects can be identified within this category, depending on which dimension of the policy landscape / process is not known by other stakeholders.
DIVERSE VALUES & WORLDVIEWS	The capacity need category of 'Diverse values and worldviews' refers to a myriad of challenges that arise from the diversity of personalities and characters of stakeholders and hinder trust and effective cooperation between them.
COMMUNICATION	Communication between scientists, policymakers and other societal actors is a critical aspect of science-policy interfaces, ensuring that scientific and other types of knowledge inform policy decisions effectively, and it is communicated well to the broader society.
FUNDING	The capacity need category of 'Funding' sheds light on the limited availability of financial resources for various stakeholders. This category highlights diverse issues that point out the need for increased funding, equitable distribution, and strategic allocation to address critical gaps in capacity.
RELEVANCE	The 'Relevance' category refers to challenges arising from the (immediate) applicability of scientific research to policy questions. It encompasses issues such as the discrepancy between the specificity of science and the practical needs of policy, the misalignment of research with the political mood, and a gap between the research focus and the actual needs of policymakers.
COMPETENCES TO CO-PRODUCE KNOWLEDGE	This category refers to weak capacities of scientific, policy, practice and societal actors to take an active part in knowledge co-production processes. According to interviews, this gap can be observed both at the level of individual skills and organizational capacities.
INTER & TRANSDISCPLINARITY	The capacity need category of 'Inter- and transdisciplinarity' underscores the challenges arising from silo thinking, fragmented and specialized approaches to knowledge production and decision-making. Silo thinking manifests in various forms, hindering holistic perspectives, inter- and transdisciplinary collaboration, and the integration of diverse knowledge domains.
INSTITUTIONAL SUPPORT	The category of institutional support refers to the need to eliminate several factors that hinder different actors' participation in SPSIs and make collaboration more difficult, such as lack of rewarding structures, lack of human resources and organizational capacities, or high level of bureaucracy.

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CAPACITY NEEDS (THEMES)	BRIEF DESCRIPTION
HARMONIZED TIMELINES	The category 'Harmonized timelines' highlights the need to overcome the temporal challenges that hinder effective collaboration and knowledge translation between science, policy and other societal actors. The various dimensions of this gap underscore the need for synchronization, flexibility, and better integration of time frames to ensure that timely, quality knowledge informs policy decisions.
TRANSPARENT DECISION-MAKING	Policy decision making is multifaceted, there are only a few points where different forms of knowledge can be channeled into the process, and even in these intervention points there are many other actors and factors that influence the decision.
RELIABILITY	The category of 'Reliability' refers to needs in ensuring that published data and results are reliable and not manipulated to reflect private interests, which is associated with the (in)dependence of scientific research both financially and institutionally.
INCLUSION	Inclusion in knowledge and policy interactions revolves around the need for a more inclusive, diverse, and participatory approach in decision-making processes related to biodiversity policy. This necessitates overcoming barriers, fostering collaboration, and acknowledging the importance of a variety of perspectives.
BRINGING PEOPLE TOGETHER	The 'Bringing people together' category refers to the importance of dialogue – i.e., mutual exchange and co creation of knowledge – between policymakers, scientists, and other knowledge providers, which was perceived by the interviewees as critical to create effective science policy interactions.
COMPLEXITY	The capacity need category 'Complexity' refers to the challenges arising from the complex and uncertain nature of scientific research and of natural processes and the difficulty of translating complexity into actionable policy recommendations. This category encompasses a range of issues that underscore the need for improved understanding, integration, and communication of complex scientific concepts within the policymaking process.
VESTED INTERESTS	Vested interests emerged in several interviews as an important factor limiting the effective function of biodiversity science-policy interfaces. This category refers to lobbying and coalition building, and its consequence, the prioritization of private interests over societal goals.

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D. FRAMEWORK TO ASSESS CAPACITY GAPS FOR IMPLEMENTING SP&MIS FOR BIODIVERSITY IN BIOVALUE.

TYPE OF GAP	IDENTIFIED GAP	QUESTION TO PRACTITIONERS & PLANNERS	*Instructions: Please focus your answer on…*
PERSONNEL & FIANNCIAL RESOURCES	**QUALIFICATIONS & KNOW-HOW** Lack of (qualified) personnel within local administrations responsible for spatial planning with capacity to properly address biodiversity issues, or with work experience in planning instruments for biodiversity	**Was it necessary to have highly experienced or qualified personnel within your administration to design or implement this instrument?**	How did you manage to do it?
	TIME MANAGEMENT Policymakers often have limited working time to devote to collaborations at the science-policy interface, to deepen the necessary knowledge to design and implement certain planning instruments for biodiversity. This often stems from institutional constraints (i.e., institutional rigidity or lack of rewarding structures), but it can also be the result of individual prioritization which is rooted in social norms, values and worldviews.	**Was it possible for you to dedicate the desired amount of time to the design or implementation of the instrument?**	Why?
	FUNDING There is limited available financial resources for various stakeholders involved in the design and implementation of certain planning instruments for biodiversity. Insufficient financial resources can, among others, limit the number of participants taking part in the process (within the administration, but also in external planning offices) or determine whether an (adequate) participation process is carried out.	**Was funding (financial resources) an issue in the design or implementation of the instrument?**	Why? (if not) How did you overcome it?
KNOWLEDGE & EXPERTISE	**DATA** Basic research is an essential part of spatial planning and must be carried out to an appropriate extent in order to provide qualified justifications of spatially differentiated decisions. Such research is immensely aided by the availability of local-specific data, which may be missing or insufficient to support planning instruments for biodiversity.	**Did you have access to the local-specific information required to design or implement the instrument?**	How? (if not) How did you overcome it?
	COMPLEX TOPIC The complexity of scientific knowledge makes it challenging to tailor it to the design of certain planning instruments for biodiversity, which can hold back its application in the context of decision-making.	**Did you find that the knowledge required to design or implement the instrument was too complex for you?**	Why?
	NEED FOR MEDIATORS The need for third party mediators who can facilitate the bidirectional flow of information between science and policy in the design, implementation and monitoring of certain planning instruments for biodiversity.	**Was it necessary to establish a structured communication pathway with relevant scientific partners or knowledge brokers in order to design or implement the instrument?**	Why? How did you do it?

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TYPE OF GAP	IDENTIFIED GAP	QUESTION TO PRACTITIONERS & PLANNERS	*Instructions: Please focus your answer on…*
LEGISLATIVE FRAMEOWRK	**SUPPORTIVE LEGAL FRAMEWORK** There is often no legal obligation to integrate biodiversity aspects into spatial planning, which usually relies on voluntary initiatives. This limits the support and necessary institutional push to integrate planning instruments for biodiversity in the repertoire of solutions available to decision-makers.	**Was the design or implementation of the instrument supported by an overarching legal framework?**	(if not) How did you do overcome this?
	LEGAL COMPLEXITY There is often a complex legal hierarchy of laws and instruments defining the legal, possibilities, mandates and objectives of the respective levels for spatial planning. As a result, there may be a lack of consistency between existing objectives, measures and activities and insufficiently aligned planning tools for biodiversity.	**Was it clear to you how the design or implementation of this instrument could be coherent with other planning legislation and/or environmental policies?**	Why?
GOVERNANCE & PROCESSES	**INSTITUTIONAL SUPPORT** There is a need to eliminate several factors that hinder the participation of different actors in planning processes for biodiversity and that make collaboration more difficult, such as lack of rewarding structures, lack of horizontal cooperation and organizational capacities, or high level of bureaucracy.	**Did you find the right institutional support (internal) to design or implement the instrument?**	What factor was most supportive in your opinion (rewarding recognition of your work, strong horizontal cooperation, low level of bureaucracy…)?
	HARMONIZED TIMELINES There is time misalignment that arises from the discrepancy between the policy cycle and the scientific process, which may impair the design and implementation of certain planning instruments for biodiversity. This usually results from the inflexibility of policies processes which fail to adjust timelines to accommodate the complexities and time requirements of quality scientific research.	**Was it possible to incorporate needed scientific inputs within the timeframe available to the design or implementation of the instrument?**	How did you do it?
	CLASHING VIEWS The difference in mindsets and attitudes among decision-makers contributes to resistance against change, hampering the integration of sustainable practices and the implementation of certain instruments for biodiversity.	**Did you reach a plausible agreement among the different decision-makers involved in the design or implementation of the instrument?**	How did it go?
	SILO-THINKING & WORKING There are challenges arising from silo thinking and working in planning authorities, with fragmented and specialized approaches to knowledge production and decision-making, which impact the design and implementation of certain planning instruments for biodiversity	**Did you experience inconsistencies or incompatibilities with different policy sectors when designing or implementing the instrument? Was implementation hindered by these incompatibilities?**	Why?
	MONITORING Sometimes, the implementation of requirements imposed by spatial plans is not reviewed after adoption. As such, it cannot be ensured that the initial, ambitious intent of planning instruments for biodiversity is put to practice or that it is actually effective.	**Did you anticipate proper monitoring measures of the instrument you have designed or implemented in terms of its application and biodiversity outcomes?**	How did you do it?

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TYPE OF GAP	IDENTIFIED GAP	QUESTION TO PRACTITIONERS & PLANNERS	*Instructions: Please focus your answer on…*
AWARENESS & POLITICAL WILL	**NATURE SEEN AS A BURDEN** The perception of nature conservation by practitioners and policymakers as a cost further highlights the challenges in implementing certain planning instruments for biodiversity.	**Did any stakeholder involved in the design or implementation of the instrument acknowledge biodiversity as a hindrance to achieving their vision for the region? How did this impact the process of designing or implementing the instrument?**	Why? How?
	STAKEHOLDER ENGAGEMENT The range of stakeholders currently engaging with policy-makers is narrow, limiting the real understanding of the problems that certain planning instruments for biodiversity are trying to address.	**Was it possible for you to widen as broad as possible the range of stakeholders involved in the process of designing/implementing the instrument?**	Why? How did you do it?
	VESTED INTERESTS Vested interests limit the effective function of planning for biodiversity. This refers to lobbying and coalition building, and its consequence, and the prioritization of private interests over societal goals. It is associated with power imbalance and the dominance of certain actors over the planning process.	**Did the interest from other sectors, including private interests, hinder the design or implementation of the instrument?**	Why?

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E. REPORTED CAPACITY GAPS FOR SP&MIs

		REGULATORY INSTRUMENTS				ACTION-BASED INSTRUMENTS		INFORMATION-BASED INSTRUMENTS	
		Qualitative and Technological Requirements (specifically Mandatory Green Roofs for new developments or redevelopments)	Land parcel ownership rearrangements	Conservation zones, greenbelts, or protected areas and sites	Land use zoning schemes in urban or rural spaces at different scales	Design-based instruments	Land acquisition	Guidelines for promoting good practices in private spaces	Biodiversity monitoring & Ecosystems Services Assessments
PERSONNEL & FINANCIAL RESOURCES	**QUALIFICATIONS & KNOW-HOW**	There is a need to update municipal building and urbanization regulations to address qualitative and technological requirements. However, the administrative division currently lacks the necessary competence for such changes.	There is a severe **lack of qualified personnel** in regional spatial planning offices, with 13 open positions that are difficult to fill. The rural location of the administration makes it challenging to attract skilled professionals, hindering the ability to implement land parcel ownership rearrangements effectively.	The implementation of conservation areas relies heavily on technical expertise, particularly in revising existing conservation zones. It is emphasized that having qualified personnel is essential to ensure the correct application of the instrument, and the involvement of scientific partners is deemed crucial for ensuring the success of these initiatives.	There is a need for qualified personnel, particularly when revising land-use zoning plans (PDM). While there are qualified staff in the municipality, the key challenge lies in their lack of experience working together across departments, as they are often assigned to other divisions. The municipality has addressed this by hiring external teams for specific tasks, like the Strategic Environmental Assessment (SEA).	The Municipality of Trento hired specific personnel to implement design-based instruments for the Fersina River requalification project. However, due to limited resources, they were able to hire only part-time staff.	and acquisition in Mafra has been limited and typically focuses on specific areas for restoration (e.g., a 16-hectare area near a camping park). The municipality lacks specialists for ecological restoration projects, which complicates the implementation of biodiversity-focused land acquisition projects.	The implementation of the guidelines for promoting good practices in private spaces in Trento required the hiring of specific personnel to oversee the process. These guidelines were integrated into the tender process for the new hospital being developed in the city, highlighting the need for specialized knowledge for their successful application.	Both municipalities (Mafra and Trento) rely on external expertise, as the task often requires the hiring of specialized teams through public tenders or the contracting of external consultants from academic institutions. This highlights the need for specialized knowledge and expertise, which is not readily available within the municipalities themselves.
	TIME MANAGEMENT	Policymakers have not prioritized this issue due to a lack of political interest, which limits time dedicated to addressing the requirements.	Limited resources are available for spatial planning tasks due to the current focus on renewable energy projects, particularly wind energy. This prioritization has led to insufficient attention and time allocated to land parcel rearrangements for rewetting peatlands.	There are no significant time management issues reported, as the primary challenge lies more in the legal and institutional constraints rather than the time allocation for implementation.	taff often face time constraints, as a significant portion of their work is dedicated to day-to-day management rather than long-term biodiversity-focused planning. Although there is some time dedicated to biodiversity within specific projects, a clear time allocation for biodiversity within zoning tasks is still lacking.	Time management was constrained as the grant for the project limited the hours available for the hired personnel. This resulted in the need for prioritization and some limitations in project development	There have been no major time management issues, but the limited number of personnel working on land acquisition processes, as well as competing priorities, may affect the speed at which projects are advanced.	no significant time management challenges were reported for the project itself, but the integration of biodiversity considerations into the hospital's design had to be done under tight timelines, leaving little room for extensive scientific research or planning.	The small, multidisciplinary teams in both municipalities find that managing time for in-depth work on biodiversity and ecosystem services is challenging. **Daily operational tasks** often take precedence, leaving limited time to focus on these complex topics. This time constraint affects the ability to prioritize and develop strategies for biodiversity conservation effectively.
	FUNDING	No specific funding challenges were noted, indicating that funding is not a primary concern for this instrument at the moment.	**Financial resources** are a significant barrier, particularly for compensating landowners whose land is affected by rewetting. The lack of funds makes it difficult to purchase land or provide fair compensation for the loss of agricultural income, a crucial issue for	Funding for the development of conservation areas has not been identified as a major issue. However, the development of these instruments has primarily been driven by **legal requirements,** rather than proactive planning or financial resources aimed	Funding for land-use zoning is mainly driven by legal requirements, with biodiversity efforts being funded primarily through structural funds when available. However, biodiversity often receives limited attention in the municipal budget.	Funding was partially available through grants for personnel and the project itself, but it was insufficient to support full-time staff for the entire duration of the project. Consequently, part-time arrangements were adopted.	One of the primary challenges for implementing land acquisition projects is a **lack of funding**. While internal municipal information helps with planning, securing the necessary funds for acquisitions is a significant obstacle.	No direct mention of funding was provided, but it is implied that **scientific partners** were essential in assisting with the data gathering and providing the necessary expertise to implement the guidelines.	The implementation of biodiversity monitoring and ecosystem services assessments is **financially challenging** due to the limited **municipal budget allocations** for biodiversity, with these areas historically receiving minimal attention. Despite legal

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			landowners' willingness to participate.	specifically at biodiversity conservation.					requirements pushing for such assessments, there remains a need for additional resources to properly fund these initiatives.
KNOWLEDGE & EXPERTISE	**DATA**	There is a lack of specialized knowledge to adequately address data needs for qualitative and technological requirements, making it difficult to apply or integrate this instrument effectively	There is insufficient **data** on future water levels and the specific parcels that would be affected by rewetting. The lack of research funding prevents the agency from gathering the necessary data to model water levels and plan for the spatial implications of rewetting.	**Data availability** is a challenge, as access to the necessary information is not always straightforward and often depends on the technicians managing these services. This can create barriers to efficient implementation, as proper data is critical for decision-making.	Access to data is not always straightforward, and its quality depends on the technical staff managing it. There has been significant improvement recently, with decision-makers becoming more aware of the importance of updated data for decision-making. However, there is still a need to invest more in human and financial resources to ensure high-quality, accessible data.	The municipality collaborated with local institutions like MUSE (Museum of Science) and the University of Trento to gather and analyze necessary data for the project. However, further data gathering is still needed for comprehensive scientific support.	The municipality relies on internal data for land acquisition decisions, but comprehensive data for ecological restoration, which is crucial for biodiversity-focused land acquisition, is not readily available, making such projects more difficult to implement.	The implementation of these guidelines was only possible with assistance from scientific partners involved in the project, and gathering the necessary data to support the guidelines was a challenge. Although the principles themselves were not complex, **data gathering** to support scientific knowledge was more difficult.	Accessing high-quality and updated data is a significant challenge. Information availability is often dependent on the **individuals managing the services** within the municipalities. Both Mafra and Trento face difficulties in acquiring relevant data, especially when it comes to specialized knowledge needed for ecosystem services. The municipalities have recognized that investing in human and financial resources to improve **data collection** and ensure its relevance will ultimately make decision-making more informed and effective.
	COMPLEX TOPIC	The complexity of the subject matter was acknowledged, and specialists are needed to properly address the requirements.	Rewetting involves **complexity**, as it affects large areas and is difficult to predict with certainty. The complexity is compounded by the **land ownership situation**, as convincing landowners to voluntarily give up their land for rewetting is challenging, and they cannot be compelled to participate.	The complexity of the instrument is highlighted by the need for strong **scientific partnerships**. For example, the Municipal Ecological Reserve (REN) is highly relevant for biodiversity and must incorporate scientific knowledge to be effective.	The complexity of zoning and biodiversity integration lies in the technical requirements and the legal framework that governs land-use planning. These complexities often lead to varying interpretations across different government entities, making it difficult to achieve a unified approach.	While the principles of design-based instruments were not overly complex, the challenge lies in gathering and utilizing data to support the scientific knowledge needed for proper implementation.	The development of land acquisition projects is not particularly complicated. However, **implementation becomes complex** due to the lack of internal expertise in ecological restoration and biodiversity-related projects.	The guidelines themselves were not seen as particularly complex, but the **gathering of data** to support the guidelines' application was identified as a challenge.	The complexity of biodiversity monitoring and ecosystem services assessments is particularly evident in the need to bridge the gap between **scientific research** and **daily operational activities**. These topics require a deep understanding, and the municipalities struggle with the complexity of communicating ecosystem services to stakeholders. This disconnect between **theoretical knowledge** from academia and the practical realities of planning and policy

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									implementation is a significant challenge.
	NEED FOR MEDIATORS	It was recognized that third-party mediators would be helpful to bridge the gap between political intentions and the technical adjustments needed to implement this instrument.	While **mediation** has been used in other processes, particularly to resolve conflicts between landowners and agencies, it has not been effectively utilized at the science-policy interface. The need for mediators to bridge this gap in the context of rewetting is recognized but not currently addressed.	There is no significant mention of the need for mediators, but it is implied that **scientific partners** play an essential role in bridging the gap between knowledge and decision-making in conservation efforts.	There are no direct references to mediators in this case, though the involvement of various stakeholders within and outside the municipality could help balance competing interests.	Scientific support from the university was required due to the lack of a dedicated department within the municipality, highlighting the importance of external mediation to fill gaps in expertise.	**External experts** are necessary to assist with ecological restoration projects, as the municipality lacks specialized technicians. These experts would help guide the planning and execution of projects with biodiversity goals.	The successful application of the guidelines was heavily reliant on **scientific partners,** who helped with gathering the necessary data and providing the expertise needed to support the project. The involvement of external specialists was crucial due to the municipality's limited internal capacity in this area.	To navigate the complexity of these topics and ensure effective implementation, **external scientific partners** and consultants play a critical role in both Mafra and Trento. The municipalities do not have enough internal capacity to manage the technical aspects, making the involvement of **external experts** essential in both the research and practical aspects of biodiversity monitoring.
LEGISLATIVE FRAMEWORK	**SUPPORTIVE LEGAL FRAMEWORK**	There is a need for national legislation updates to support new urbanization projects that align with qualitative and technological requirements.	There is **no overarching legal framework** supporting land parcel ownership rearrangements for rewetting projects. This lack of legal structure limits the instrument's applicability and prevents the full implementation of rewetting efforts at a broader scale.	While there is an existing **legal framework** that influences biodiversity (e.g., REN), it is considered **insufficient**. The current legal framework does not directly address biodiversity issues, but it indirectly influences them. The legal obligations related to biodiversity are seen as very limited, and a more robust legal structure would be needed to strengthen conservation efforts.	The legal framework governing land-use zoning, such as the PDM and REN, ensures that biodiversity is considered. However, the adaptation of these frameworks to specific technical requirements often creates delays, complicating timely implementation.	The Provincial Urban Plan mandated that municipalities align their instruments with the regional requirements (e.g., fluvial ecological extension of protected areas). The master plan for the Fersina River requalification was a voluntary initiative by the municipality.	There is a **legal framework** for ecological restoration, but it is primarily infrastructure-oriented, with limited specific guidance for biodiversity-related projects. The framework is considered too general for effectively supporting land acquisition aimed at biodiversity conservation.	The integration of guidelines for promoting good practices in private spaces was foreseen under **provincial regulations**. However, these guidelines were **non-binding**, which meant that their implementation was not mandatory but encouraged.	The **legal framework** for biodiversity monitoring and ecosystem services assessments exists but requires **more detailed guidelines** and specific resources to ensure its successful implementation. They are usually implemented to support other instruments. In Mafra, for instance, the revision of the **Rede Ecológica Nacional (REN) would benefit from these assessment and** will require substantial input from academic and scientific partners.
	LEGAL COMPLEXITY	There is a challenge in aligning the existing legal framework with the changes needed for these new requirements. This would require adjustments to the current regulations.	The instrument itself is well-established and generally clear in its design, but the **legal complexity** arises from the need to address landowners' voluntary participation and the uncertainty regarding the best way to implement it within the existing legal framework.	The instrument is supported by national plans that tie in with local plans, making the **legal framework** a bit more structured. However, there is still a gap in terms of the direct impact of legal frameworks on biodiversity protection, which limits the effectiveness of the tool in conservation planning.	The complexity of legal requirements increases as the PDM and REN become more detailed and technically demanding. This makes it difficult to interpret and apply the laws consistently across different departments, leading to fragmented approaches.	There was a need to navigate through the complexities of aligning the project with various levels of local institutions and legal frameworks. The project required evaluation from multiple departments, which added to the complexity of implementation.	There is a need for further **training** to ensure that the municipality can navigate and implement land acquisition projects within the existing legal framework. While the legal context is in place, more specialized knowledge on integrating biodiversity into land acquisition projects is required	There were no significant legal challenges, as the guidelines were voluntary under provincial regulations. However, the voluntary nature of the guidelines meant that their successful integration relied more on willingness and alignment with other planning objectives.	Legal complexities arise, especially in relation to **compliance** with national and regional frameworks for biodiversity conservation. These complexities often result in the need for additional legal clarity, as municipalities are required to adapt scientific findings into

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									planning instruments in a legally sound manner.
GOVERNANCE & PROCESSES	**INSTITUTIONAL SUPPORT**	The current institutional framework does not fully support these changes, primarily due to a lack of political will to advance the necessary modifications.	While the tool is generally accepted in other processes, **institutional support** for its use in rewetting projects is lacking. Awareness of its applicability for rewetting is low among key stakeholders, leading to underutilization of the instrument for these purposes.	The **institutional support** for the revision of the REN is generally positive. The support from internal leadership, particularly from the planning and spatial planning divisions, has been strong. Additionally, political decision-makers have shown openness to integrating biodiversity into spatial planning, which has facilitated further progress.	Strong support for biodiversity comes from political leaders and the division of Spatial Planning, as they understand the importance of balancing development with environmental preservation. However, this support is not always consistent throughout the entire municipality.	While the project had strong support from local and provincial institutions, there were bureaucratic challenges, especially due to the sensitive nature of the project. High levels of internal cooperation were necessary but were often hindered by institutional layers.	While there is some institutional support, particularly from the municipality, other priorities, such as urban development and infrastructure, often take precedence over biodiversity-focused land acquisition, hindering the overall progress of biodiversity conservation efforts.	While there was some **institutional support**, particularly in integrating the guidelines into the tender brief for the hospital, **institutional planning** at higher levels of governance (e.g., provincial level) made it difficult to dedicate enough time for more in-depth scientific research. Thus, the integration of biodiversity was seen as secondary to the hospital's primary functions.	**Institutional support** in both municipalities has been evolving, with increasing awareness of the importance of biodiversity and ecosystem services. However, **horizontal information sharing** remains limited, and internal cooperation could be further strengthened to facilitate effective planning and monitoring.
	HARMONIZED TIMELINES	There is no specific mention of timeline misalignments in this case.	There is no specific mention of issues related to **harmonized timelines** in this case, though the complexity of rewetting may lead to misalignment in time expectations between planning and implementation.	No major issues were identified with **harmonizing timelines**, suggesting that the timeline for revising the REN and implementing conservation zones is manageable.	There is often a misalignment between the timelines of land-use planning processes and the more detailed, technical requirements of biodiversity integration. This leads to difficulties in ensuring that biodiversity considerations are properly integrated within the overall planning cycle.	Timelines were somewhat impacted by the need for coordination across various institutional levels, particularly due to the sensitive environmental and political aspects of the project.	There are no clear timelines outlined for land acquisition processes, partly due to competing priorities within the municipality and the challenge of securing the necessary funding and expertise for biodiversity projects.	**Time constraints** were a significant issue, as the hospital's design had strict deadlines. This meant that there was limited time for comprehensive scientific research and planning on how to integrate biodiversity through nature-based solutions – and to delineate the recommendations	The timelines for implementing these instruments often clash with the broader planning processes in both municipalities. Both **Mafra and Trento** have faced **timing issues**, as biodiversity and ecosystem services considerations are often secondary to more immediate and operational planning needs, making it difficult to integrate them effectively into project timelines.
	CLASHING VIEWS	The primary barrier is political interest rather than conflicting views among decision-makers, making it difficult to alter the municipal regulations to align with this instrument.	There are no significant **clashing views** noted among decision-makers. However, landowners' reluctance to exchange agricultural land for less valuable land can be seen as a form of conflict that limits the instrument's effectiveness.	No significant **clashing views** were noted. However, there are **institutional silos** present in the planning process, particularly when it comes to cooperation between different divisions within the municipal administration. This lack of horizontal collaboration may hinder the full integration of biodiversity concerns into spatial planning.	Conflicting interests arise between urban development and biodiversity preservation. Expanding urban areas or building new infrastructures often conflict with conservation goals, as they may occupy the same spaces or resources. Balancing these competing goals within the municipal	The project faced mixed reception, with positive responses from local provincial institutions, but a negative response from the national government, particularly regarding land use for housing construction, which hindered negotiations.	Internal **disagreements** have emerged, particularly regarding the type of funding needed for biodiversity-focused land acquisition. The municipality's focus on infrastructure projects has led to tension between departments.	There were no major clashes, but the integration of biodiversity considerations in the hospital design was **secondary** to fulfilling the primary functional requirements of the hospital, which led to the prioritization of practical aspects over environmental goals.	Some stakeholders continue to view biodiversity and ecosystem services as secondary concerns, especially when these priorities clash with other **economic or development objectives**. This often leads to a lower prioritization of biodiversity considerations in the planning process.

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					planning framework is a key challenge.				
	SILO-THINKING & WORKING	No mention of silo-thinking was explicitly noted, but the issue of political disinterest suggests that lack of horizontal cooperation could be a factor.	There is no direct mention of **silo-thinking**. However, the lack of coordination across various sectors, particularly between landowners, environmental agencies, and policy makers, can hinder the smooth implementation of land rearrangement projects.	The lack of cooperation between different divisions within the municipality, particularly in terms of designing the REN, is an obstacle to effective planning. The lack of habitual collaboration across divisions makes the process more fragmented, slowing down the integration of biodiversity into urban planning.	The siloed working structures within the municipality, where divisions operate independently without sufficient collaboration, hinder the efficient integration of biodiversity into land-use zoning. This lack of cooperation across departments creates barriers in aligning spatial planning with biodiversity goals.	While there was a high degree of horizontal internal cooperation between different departments and levels of government, bureaucratic structures made collaboration more challenging, especially due to the project's sensitivity.	There is a **lack of coordination** between the municipality's departments involved in land acquisition. The municipal works sector, for instance, struggles to adapt to projects that are not related to building construction, making it difficult to implement land acquisition for non-infrastructure uses such as biodiversity restoration.	No specific issues with silo-thinking or working were reported. However, the **integration of biodiversity** into the hospital project was likely influenced by the collaboration between various departments, with some prioritizing biodiversity over others.	In both municipalities, there is a tendency for **silo-thinking** between different departments, with **biodiversity and ecosystem services** not always integrated across various sectors. This lack of cross-departmental collaboration hampers effective implementation.
	MONITORING	No specific monitoring concerns were raised – instrument not implemented.	No specific concerns were raised regarding **monitoring**, but effective monitoring is likely necessary to ensure the success of rewetting projects and the proper implementation of land ownership rearrangements.	No specific concerns were raised about the **monitoring** of conservation zones, greenbelts, or protected areas, but it is assumed that proper monitoring mechanisms are important for ensuring the effective application and management of these zones.	Monitoring efforts are often constrained by political priorities that favor development over environmental preservation. Public discussions tend to focus more on land development and construction capacity, rather than on the long-term environmental impacts of land-use changes.	Monitoring of biodiversity enhancements was supported by scientific partners, but there were challenges related to the maintenance of vegetation, where institutional stakeholders sometimes saw biodiversity enhancement as a safety concern.	Monitoring plans are not specified in the results, though it can be inferred that monitoring of ecological restoration and biodiversity impacts would be necessary once the land acquisition is completed.	No specific details on monitoring were provided, though it can be inferred that **monitoring** of the implementation of the guidelines for promoting good practices would be needed after their integration into the hospital's design.	**Monitoring** is crucial for tracking biodiversity changes and assessing ecosystem services, but the municipalities face challenges in maintaining continuous and effective monitoring efforts due to a lack of dedicated resources. However, **ecosystem services monitoring** is increasingly being integrated into new planning policies, signaling positive progress in this area.
AWARENESS & POLITICAL WILL	**NATURE SEEN AS A BURDEN**	The issue here appears to be political reluctance rather than perceiving nature as a burden.	**Biodiversity** is not viewed as a hindrance to rewetting projects; in fact, it is considered a by-product. However, the main focus remains on the technical aspects of rewetting for climate change mitigation, rather than fully integrating biodiversity as a primary goal.	Biodiversity is generally not seen as a burden in this context. On the contrary, it is seen as a positive element that enhances the planning process, with political decision-makers supporting its integration into planning initiatives.	Biodiversity is not often seen as a valuable factor in land-use decisions. There is a prevailing mindset that non-buildable land should be reclassified as urban, even if it is incompatible with construction from an ecological standpoint. This reflects a general undervaluing of biodiversity in land-use planning.	Some institutional stakeholders, particularly those in charge of vegetation maintenance, viewed biodiversity enhancement as a safety issue, and legal responsibilities were a significant concern.	While not explicitly stated, the difficulty of implementing these projects suggests that **biodiversity is not seen as a priority**, particularly when compared to more immediate infrastructure needs.	Biodiversity and nature-based solutions were considered secondary to the hospital's primary needs, meaning that while the guidelines were included in the project, biodiversity was not seen as a central priority.	Both municipalities still struggle with the perception of nature as a **burden**, particularly in planning and development contexts. There is a disconnect between the immediate **economic** or **functional needs** of urban development and the long-term benefits of biodiversity and ecosystem services.
	STAKEHOLDER ENGAGEMENT	There was no detailed mention of stakeholder engagement, but the focus seems to be more	**Stakeholder engagement** is limited, particularly among landowners, who are reluctant to	**Stakeholder engagement** seems to be limited, as no explicit mention was made of the	Public participation in zoning discussions is often legally mandated, but it does not always	The project benefitted from a good local network and the willingness of local stakeholders to cooperate,	Stakeholder engagement has been **limited so far**, with stakeholders expected to be involved as	**Stakeholder engagement** was likely limited to the specific actors involved in the	Stakeholder engagement in both municipalities is often reactive rather than proactive. While **external**

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		on overcoming political disinterest	participate in land exchanges. This reluctance hampers the ability to achieve the necessary land rearrangements for rewetting.	involvement of external stakeholders. However, internal cooperation is strong, particularly with decision-makers and planning staff, which has been beneficial for advancing biodiversity in planning.	lead to a meaningful engagement on biodiversity issues. The focus during these consultations tends to be on development opportunities, leaving little room for the consideration of ecological concerns.	which was crucial for advancing the initiative. However, the engagement was more limited in the areas with private ownership.	the project progresses. However, the slow pace of decision-making and project development has delayed more active engagement.	design and implementation process. The municipality and province coordinated on integrating the guidelines, but broader stakeholder engagement outside of the project was not mentioned.	**scientific partners** and other stakeholders are involved, the degree of engagement with local communities or other relevant actors could be strengthened.
	VESTED INTERESTS	The primary barrier appears to be political vested interests, which hinder the progression of changes to regulations that would support these qualitative and technological requirements.	The issue of **vested interests** is prominent, as landowners are resistant to exchanging highly productive agricultural land for land with lesser value, which is seen as a significant barrier to the success of land parcel ownership rearrangements.	There are no specific concerns about **vested interests** interfering with the planning process for conservation zones. However, the lack of engagement from external stakeholders could imply that broader societal interests are not fully represented in decision-making.	The planning process is influenced by vested interests in maximizing the developable potential of land. This often undermines biodiversity considerations, as the demand for urbanization and construction capacity takes precedence over environmental sustainability.	The project benefitted from a good local network and the willingness of local stakeholders to cooperate, which was crucial for advancing the initiative. However, the engagement was more limited in the areas with private ownership.	**Private landowners** play a significant role in hindering the process, as they set the prices for land sales. Additionally, the lengthy expropriation process is a barrier to acquiring land for biodiversity conservation.	The **Defence Ministry** owned part of the land adjacent to the hospital project, and there were issues with potential housing development in that area. Despite attempts by the municipality and province to negotiate, their efforts were rejected, which could potentially conflict with the biodiversity goals for the area.	Vested interests, such as those from development or construction sectors, can **complicate the process** of integrating biodiversity monitoring and ecosystem services assessments into planning. In both municipalities, balancing **development goals** with conservation objectives remains a challenge.

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F. CONTRIBUTION ANALYSIS – SP&MIs and Biodiversity

Yellow cells indicate conditional or potential contribution. Green cells indicate straightforward contribution.

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
ENFORCEMENT	**Expropriation of land**	Only if management practices post-expropriation are supporting the maintenance or improvement of the ecological conditions of the targeted natural area. To this end, this can be implemented together with SP&MIs such as guidelines and recommendation for public development and qualitative requirements to further enhance biodiversity values in the targeted area. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of the ecological conditions in the targeted area.	The sole purpose of expropriating land for biodiversity is to increase or at least maintain the area of natural habitats that are risk due to bad management, or that are of interest for the presence of relevant natural values (key species, green corridors, etc.), as the ultimate solution for halting land take and development.	Only if the expropriation is carried out in a way that creates a network to support habitat connectivity. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas to be preserved. It should also be coupled with monitoring programs to ensure that connectivity is maintained in areas under high pressure for development and urbanization.
ENFORCEMENT	**Administrative Possession**	The sole purpose of this tool is to maintain or restore ecosystems at risk due to current private bad management or lack thereof. As such, its implementation is enforced with the adoption of management activities designed to restore the ecological conditions in the targeted area. Should be coupled with EA instruments such as monitoring/condition indicators to support the maintenance and ideally improvement of the ecological conditions in the target area after possession is reverted.	The implementation of administrative possession for biodiversity serves as main purpose the maintenance or expansion of existing natural habitats that are at risk due to bad management or negligence.	Only if the targeted area creates a connection with existing natural structures. The selection of targeted areas is primarily based on current management practices, but priority can be given to intervention in areas with higher potential for habitat connectivity and the creation of green networks. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help prioritize areas in which to intervene. It should also be coupled with monitoring programs to ensure that connectivity is maintained in areas under high pressure for development and urbanization.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
ENFORCEMENT	**Preemption rights**	Only if management practices post-acquisition are supporting the maintenance or improvement of the ecological conditions of the targeted natural area. To this end, this can be implemented together with SP&MIs such as guidelines and recommendation for public development and qualitative requirements to further enhance biodiversity values in the targeted area. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of the ecological conditions in the targeted area.	The sole purpose of exerting preemption rights for biodiversity is to increase ot at least maintain the area of natural habitats (to be kept from development)	Only if the expropriation is carried out in a way that creates a network to support habitat connectivity. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas to be preserved. It should also be coupled with monitoring programs to ensure that connectivity is maintained in areas under high pressure for development and urbanization.
REGULATION-BASED INSTRUMENTS	**Quantitative targets or standards**	These standards and targets usually fail to increase the quality of the new natural area(s) being implemented. Should be implemented with quantitative standards in order to ensure habitat quality in these new areas. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to make sure requirements support the desired ecological conditions of the new natural area(s).	Targets and standards are usually defined based on an increase in area dedicated to natural habitats or permeable surfaces. In this sense it contributes straight to an increase in area of habitat.	Only if the new areas meeting the targets or standards are connected or create a connection with existing natural structures. If implemented under a strategic plan or program in such way, or in combination with other SP&MIs such as land-use zoning, it can be used to increase connectivity of permeable surfaces (urban settings) or multifunctional habitats (agricultural settings).
REGULATION-BASED INSTRUMENTS	**Qualitative and Technological Requirements**	The qualitative requirements are usually defined based on relevant characteristics of natural areas that should be ensured in the new development or re-development. If possible, can be coupled with quantitative targets (i.e., % of tree canopy cover in forested patches) and with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to ensure that the requirements support the desired ecological conditions of the natural habitats being created.	The implementation of qualitative elements and technologies will not necessarily increase the available area of natural habitats, but they might be the case for specific requirements such as installation of GI. Can be coupled with quantitative targets to ensure net increase in area of habitat.	The implementation of qualitative elements and technologies will not necessarily contribute to habitat connectivity, but they might be the case if implemented with other SP&MIs such as land-use zoning, to strategically plan which areas will be subject to these requirements.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
REGULATION-BASED INSTRUMENTS	**Compensation measures**	Only if the measures implemented can offset the damages posed by the development in the first place. Biodiversity monitoring and ES assessment can help design the necessary measures. Could be coupled with EA instruments such as enhancement measures to ensure this net increase, and monitoring programs to ensure continuity.	Only if the measures implemented go beyond the area impacted by the development or redevelopment, thus leading to a net increase in the available area of natural habitats. Could be coupled with quantitative targets to ensure this net increase.	Only if compensated areas create a connection with existing natural structures. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help prioritize areas in which to intervene. It should also be coupled with monitoring programs to ensure that connectivity is maintained post-implementation.
REGULATION-BASED INSTRUMENTS	**Performance-based approaches with point systems**	Should be coupled with quantitative targets and/or qualitative requirements to ensure the presence of specific natural elements that contribute to habitat quality. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to ensure that the point system actually supports the desired ecological conditions of the natural habitats defining the intended performance.	These point system-based instruments are mostly exclusively applied to surface of green and blue infrastructure. In this sense, it contributes directly to an increase in area of natural habitats.	Only if the point system takes into account the fragmentation of the green and blue infrastructure in the area where the instrument is applied. To this end, it can be coupled with EA instruments such as monitoring indicators (e.g., landscape fragmentation) to favor connectivity through the scoring system.
REGULATION-BASED INSTRUMENTS	**Conservation zones, greenbelts, or protected areas and sites**	The definition of restrictions to both development and specific activities within conversation zones contributes straight to increase the quality of natural habitats. It can be implemented together with other SP&MIs like guidelines and recommendation for both public and private development to further enhance biodiversity values. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions of the natural habitats being preserved	The definition of new specific sites or green areas to be preserved contributes straight to an increase in area of habitat. If possible, it should be implemented coupled with quantitative targets quantitative targets (i.e., % of protected land within a landscape) to ensure a net increase in the available natural habitat areas being preserved.	Only if the areas preserved or new areas to be preserved are designed in a network created to support habitat connectivity. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas to be preserved.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
REGULATION-BASED INSTRUMENTS	**Land parcel ownership rearrangements**	Only if the requirements defined in the agreement are protective of natural elements that contribute to the quality of the specific habitat(s). To this end, it should be coupled with other SP&MIs such as guidelines and recommendation for both public and private development or qualitative requirements to further enhance biodiversity values. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions in the readjusted parcels.	The implementation of land rearrangements, along with its specific requirements, allows for the creation of new natural habitats.	The implementation of land rearrangements, along with its specific requirements, allows the creation of new natural habitats that are connected in space, thus straightly contributing to connectivity. It could be coupled with EA instruments such as condition indicators on landscape fragmentation to help prioritize areas in which to intervene.
REGULATION-BASED INSTRUMENTS	**Land use zoning schemes in urban or rural spaces at different scales**	The management restrictions that come with such land use zoning schemes are usually not sufficient to contribute to enhancing habitat quality. To this end, it should be coupled with other SP&MIs such as guidelines and recommendation for both public and private development or qualitative requirements to further enhance biodiversity values. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to further specify the permitted/forbidden uses that support the maintenance or improvement of the ecological conditions in the zoned areas.	The implementation of such land use zoning schemes directly contributes to increasing the availability of natural habitats, or maintaining existing ones. It should be implemented coupled with quantitative targets at the local/regional level to ensure a net increase in the available natural habitat areas being implemented through land-use zoning.	Only if the areas being created or maintained through land-use zoning are designed in a network to support habitat connectivity. We found evidence of such considerations in plans from T1.1 (e.g., GDP Vittoria-Gasteiz). To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas to be preserved. It should also be coupled with monitoring programs to ensure that connectivity is maintained in areas under high pressure for development and urbanization.

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**	The specifications included under these projects are usually defined to support the maintenance or improvement of the ecological conditions of the targeted natural area, through the design of specific nature-based solutions, thus directly contributing to the ecological quality of these areas. They can be implemented together with SP&MIs such as guidelines and recommendation for both public and private development and qualitative requirements to further enhance biodiversity values in the targeted area. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions of the targeted area.	The sole purpose of these projects is to increase or at least maintain the area of natural habitats through the design of nature-based solutions.	Only if the instrument is implemented in a way that targets potential natural areas spatially connected in a network. This instrument tends to favor connectivity when applied under a strategic programme for creating green networks. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide or prioritize where to intervene. It should also be coupled with monitoring programs to ensure that connectivity is maintained (e.g., the surrounding natural areas could be potentially subject to development, disrupting connectivity).
PROJECT OR ACTION-BASED INSTRUMENTS	**Land acquisition**	Only if management practices post-acquisition are supporting the maintenance or improvement of the ecological conditions of the targeted natural area. To this end, this can be implemented together with SP&MIs such as guidelines and recommendation for public development and qualitative requirements to further enhance biodiversity values in the targeted area. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of the ecological conditions in the targeted area.	The sole purpose of exerting preemption rights for biodiversity is to increase ot at least maintain the area of natural habitats (to be kept from development)	Only if the acquisition is carried out in a way that creates a network to support habitat connectivity. As locations available for acquisition are dependent on various externals factors, priority can be given to implementing this instrument in areas that would expand green networks. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas to be acquired.

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
PROJECT OR ACTION-BASED INSTRUMENTS	**Contractualizations, Partnerships and Stewardships, including Conservation Easements**	The contractual obligations included under these instruments are usually defined to support the maintenance or improvement of the ecological conditions of the targeted natural area, thus directly contributing to the ecological quality of these areas. They can be implemented together with SP&MIs such as guidelines and recommendation for both public and private development and qualitative requirements to further enhance biodiversity values in the targeted area. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions of the targeted area.	This set of instruments are designed to restrict or condition development, management or use of the land in targeted natural areas. In this sense, they directly contribute to increasing or maintaining natural areas.	Only if the instrument is implemented in a way that targets potential natural areas spatially connected in a network. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas in which to intervene.
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**	These guidelines are designed to support restoration or maintenance of desired ecological conditions in the targeted area, directly contrjibuting to habitat quality. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions of the targeted area.	The recommendations issued under these guidelines support the creation or maintenance of natural areas. They can be coupled with quantitative targets when linked to a specific development to ensure net increase in the size of natural areas being targeted.	Only if the instrument is implemented in a way that targets potential natural areas spatially connected in a network. The location of interventions is not dictated by the instrument, however. Can only address connectivity when coupled with other regulatory instruments. It is more effective if coupled with regulation-based instruments (to ensure compliance).
INFORMATION-BASED INSTRUMENTS	**Guidelines for promoting good practices in private spaces**	These guidelines are designed to support restoration or maintenance of desired ecological conditions in the targeted area, directly contrjibuting to habitat quality. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions of the targeted area. It is more effective if coupled with regulation-based instruments (to ensure compliance).	The recommendations issued under these guidelines support the creation or maintenance of natural areas. They can be coupled with quantitative targets when linked to a specific development to ensure net increase in the size of natural areas being targeted. It is more effective if coupled with regulation-based instruments (to ensure compliance).	Only if the instrument is implemented in a way that targets potential natural areas spatially connected in a network. The location of interventions is not dictated by the instrument, however. Can only address connectivity when coupled with other regulatory instruments. It is more effective if coupled with regulation-based instruments (to ensure compliance).

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
INFORMATION-BASED INSTRUMENTS	**Biodiversity monitoring & Ecosystems Services Assessments**	Ecosystem condition indicators, including biodiversity specific (species richness, presence of invasive species, etc.) contribute to improving the design and implementation of SP&Mis that support habitat quality, if used to support decision-making and the instruments are actually implemented. ES-centered assessments need to address various biodiversity values (as explained in D1.3), be coupled with ecosystem condition assessments, or otherwise incorporate biodiversity indicators when integrated into a decision-support system in order to contrubite to habitat quality.	Ecosystem condition indicators and biodiversity assessment and monitoring indicators can contribute to the identification of natural areas that should be targetd for preservation or restoration (e.g., presence of relevant biodiversity, ecological corridors, nursing habitats, etc), if used to support decision-making through SP&MIs that are actually implemented.	Landscape fragmentation indicators specifically contribute to improving the design and implementation of SP&MIs that can support habitat connectivity, if used to support decision-making and the instruments are actually implemented. Can also support EA instruments and monitoring programs to ensure habitat connectivity.
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	Only if the criteria associated with the bonuses are related to natural elements that support the ecological quality condition of the targeted area. To this end, this can be implemented with quantitative standards in order to ensure habitat quality. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to make sure criteria support the desired ecological conditions of the targeted natural area(s). EA instruments can also be used to verify that the densification option for the development is not further damaging surrounding ecosystems (i.e., increased pollution, traffic, etc), otherwise counterbalancing the potential positive impacts on habitat quality.	Only if the criteria associated with the bonuses can contribute to a net increase of natural areas, accounting for the area being developed/densified. Can be coupled with EA instruments (such as EIA) to ensure this net increase.	Only if the targeted area creates a connection with existing natural structures. The selection of targeted areas is not possible, given that this instrument pertains to a specific development, but priority can be given to bonuses intervention in areas with higher potential for habitat connectivity - e.g., peri-urban areas in expansion. It should also be coupled with monitoring programs to ensure that connectivtity is maintained (e.g., the surrounding natural areas could be potentially subjetc to development, disrupting connectivity).

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MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
INCENTIVE-BASED INSTRUMENTS	**Transfer of development rights (TDR) mechanisms**	The contractual obligations included in TDRs are usually defined to support the maintenance or improvement of the ecological conditions of the targeted natural area, thus directly contributing to the ecological quality of these areas. They can be implemented together with SP&MIs such as guidelines and recommendation for both public and private development and qualitative requirements to further enhance biodiversity values in the targeted area. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to support the maintenance or improvement of ecological conditions of the targeted area.	TDRs are deisgned to condition development, management or use of the land in targeted natural areas. In this sense, they directly contribute to increasing or maintaining natural areas.	Only if the targeted areas are spatially connected with other natural /undeveloped areas. To this end, it could be coupled with EA instruments such as condition indicators on landscape fragmentation to help decide on new areas to be preserved. It should also be coupled with monitoring programs to ensure that connectivtity is maintained (e.g., the surrounding natural areas could be potentially subjetc to development, disrupting connectivity).
INCENTIVE-BASED INSTRUMENTS	**Fast-tracking approval process**	Only if the greening interventions foreseen are related to natural elements that support the ecological quality of the targeted area. To this end, this can be implemented with qualitative requirements in order to ensure habitat quality. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to make sure the interventions foreseen support the desired ecological conditions of the targeted natural area(s).	Only if the greening interventions foreseens can contribute to a net increase of natural areas, accounting for any area other being developed/urbanized as part of the same project. Can be coupled with EA instruments such EIA to ensure this net increase.	Only if the greening interventions create a connection with existing natural structures. The selection of targeted areas is not possible, given that this instrument pertains to a specific project, but if needed priority can be given to projects in areas with higher potential for habitat connectivity - e.g., projects incorporating greenng interventions in peri-urban areas in expansion. It should also be coupled with monitoring programs to ensure that connectivtity is maintained (e.g., the surrounding natural areas could be potentially subjetc to development, disrupting connectivity).

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	HABITAT QUALITY	AREA OF HABITAT	CONNECTIVITY
INCENTIVE-BASED INSTRUMENTS	**Interim use permits (abandoned/vacant lots)**	Only if the specific terms defined are related to natural elements that support the ecological quality of the targeted area. To this end, this can be implemented with qualitative requirements in order to ensure habitat quality. Can also be coupled with information-based instruments (on Biodiversity and ES) as well as EA instruments such as monitoring/condition indicators to make sure the specific terms of usage support the desired ecological conditions of the targeted natural area(s).	These permits are usually issued to condition development, management or use of the land in targeted natural areas, focusing on green or blue infrastructures. In this sense, they directly contribute to increasing or maintaining natural areas.	Only if the targeted areas are spatially connected with other natural /undeveloped areas. The selection of targeted areas is not possible, given that this instrument pertains to specific locations - abandoned or vacant lots. However, if needed, priority can be given to implement this instrument in areas with higher potential for habitat connectivity - e.g., peri-urban areas in expansion. It should also be coupled with monitoring programs to ensure that connectivtity is maintained (e.g., the surrounding natural areas could be potentially subjetc to development, disrupting connectivity).

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G. CONTRIBUTION OF SP&MIS TO THE THREE AMBITIONS FOR TRANSFORMATIVE CHANGE

MAIN CATEGORY	SPATIAL PLANNING & MANAGEMENT INSTRUMENT	AMBITION #1 Spatial planning safeguards, restores, allows recovery and enhances biodiversity		AMBITION #2 Spatial planning significantly contributes to balanced and responsible consumption and production without external social and environmental costs	AMBITION #3 Spatial planning significantly contributes to reducing socioeconomic inequalities.
		SUMMARY OF POTENTIAL CONTRIBUTION TO BIODIVERSITY AND ES	*POTENTIAL THREATS/COST SHIFTING TO OTHER SECTORS, LANDSCAPES OR ACTORS*	SUMMARY OF POTENTIAL CONTRIBUTION TO AVOIDING OR REDUCING ENVIRONMENTAL AND SOCIAL COSTS	SUMMARY OF POTENTIAL CONTRIBUTION TO ENHANCING ACCESS TO ENVIRONMENTAL BENEFITS AND REDUCING SOCIO-ECONOMIC INEQUALITIES
ENFORCEMENT	**Expropriation of land**	The instrument has good potential to contribute to safeguarding biodiversity and potentially enhancing it by increasing area of natural habitats. It can address habitat quality and connectivity if coupled with other instruments, where it can increase the supply of ES in various contexts (urban, rural, peri-urban).	*Extreme measure designed to remove control from private agents. In certain cases, weak governance and poor land use planning when implementing this instrument may actually negatively impact biodiversity and customary rights and livelihoods (early examples from the REDD initiative). Costs may shift to public budgets (e.g., compensation to landowners) or sectors relying on that land (e.g., agriculture, forestry).*	Prevents environmentally harmful activities on ecologically valuable land, preserving ecosystems and reducing pollution or habitat loss. But it may also contribute to displacement of communities and social resistance due to perceived inequity in expropriation.	The instrument has the potential to increase supply of various ES that can be characterized as public goods but it depends on what type of post-expropriation management is employed by the public agent. If equitably managed, it can redistribute land for affordable housing or conservation, benefiting marginalized groups. Shows low to zero potential for integrating participatory processes (enforcement).
ENFORCEMENT	**Administrative Possession**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing it, directly contributing to area of habitat and habitat quality. It	*May shift maintenance and management costs from private to public institutions.*	Prevents environmentally harmful activities on ecologically valuable land, preserving ecosystems and reducing pollution or habitat loss. This may improve local	Promotes shared benefits if public institutions prioritize access for underserved communities or local resource use. Shows low potential

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		SUMMARY OF POTENTIAL CONTRIBUTION TO BIODIVERSITY AND ES	*POTENTIAL THREATS/COST SHIFTING TO OTHER SECTORS, LANDSCAPES OR ACTORS*	SUMMARY OF POTENTIAL CONTRIBUTION TO AVOIDING OR REDUCING ENVIRONMENTAL AND SOCIAL COSTS	SUMMARY OF POTENTIAL CONTRIBUTION TO ENHANCING ACCESS TO ENVIRONMENTAL BENEFITS AND REDUCING SOCIO-ECONOMIC INEQUALITIES
		can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts, but usually used in urban settings.		environmental quality for nearby residents. However, can be met with social resistance.	for integrating participatory processes (enforcement).
ENFORCEMENT	**Preemption rights**	The instrument has good potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat. It can address habitat quality and connectivity if coupled with other instruments, where it can increase the supply of ES in various contexts (urban, rural, peri-urban).	*May shift maintenance and management costs from private to public institutions.*	By giving priority to conservation-focused activities in the targeted area, it may contribute to safeguard ecologically significant lands from harmful development. However, can be met with social resistance.	Ensures access to critical resources or spaces for vulnerable groups, especially if linked to affordable housing or community land trusts. Shows low potential for integrating participatory processes (enforcement).
REGULATORY	**Quantitative targets or standards**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing it by increasing area of habitat. It can address habitat quality and connectivity if coupled with other instruments, where it can increase the supply of ES in various contexts (urban, rural, peri-urban).	*If not applied with equalization of benefits and burdens, may increase costs for sectors needing to meet stringent standards (e.g., developers, manufacturers). For example, the construction sector (and ultimately affect the housing market) by*	The instrument may contribute to micro-climate regulation in urban contexts, decreasing energy consumption in buildings by increasing permeable surfaces and tree canopy cover. Higher costs associated with compliance could increase prices for consumers (social cost).	The instrument is usually applied to private areas with limited accessibility, but can potentially increase the supply of ES that are public goods. May improve public health outcomes for low-income groups often disproportionately exposed to pollution, narrowing health inequalities.

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		SUMMARY OF POTENTIAL CONTRIBUTION TO BIODIVERSITY AND ES	*POTENTIAL THREATS/COST SHIFTING TO OTHER SECTORS, LANDSCAPES OR ACTORS*	SUMMARY OF POTENTIAL CONTRIBUTION TO AVOIDING OR REDUCING ENVIRONMENTAL AND SOCIAL COSTS	SUMMARY OF POTENTIAL CONTRIBUTION TO ENHANCING ACCESS TO ENVIRONMENTAL BENEFITS AND REDUCING SOCIO-ECONOMIC INEQUALITIES
			increasing the cost of production or the agriculture sector when applied to farming practices (ultimately affecting food prices) usually by decreasing arable area.		
REGULATORY	**Qualitative and Technological Requirements**	The instrument has good potential to contribute to safeguarding biodiversity and potentially enhancing it by supporting habitat quality. It can contribute to area of habitat depending on the type of requirement, and if coupled with other instruments (quantitative targets). It can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts (urban, rural, peri-urban).	*If not applied with equalization of benefits and burdens, may increase costs for sectors needing to adopt higher standards or new technologies. (e.g., developers, manufacturers). For example, the construction sector (and ultimately affecting the housing market) by increasing the cost of production, or the agriculture sector when applied to farming practices (ultimately affecting food prices) by decreasing arable area or*	Qualitative requirements related to green installations may reduce pollution caused by cooling of indoor environments in summer months. It can also provide benefits in terms of reduced water runoff. May create financial barriers for smaller businesses or industries with fewer resources to compete in the market (social cost)	Creates opportunities for green jobs and upskilling, especially for workers in low-income sectors transitioning to cleaner technologies (water management, energy) and green infrastructure installation. May contribute to increasing living conditions in lower income communities depending on the role of public entities in its implementation (i.e., if introduced as requirements for social housing projects).

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		SUMMARY OF POTENTIAL CONTRIBUTION TO BIODIVERSITY AND ES	*POTENTIAL THREATS/COST SHIFTING TO OTHER SECTORS, LANDSCAPES OR ACTORS*	SUMMARY OF POTENTIAL CONTRIBUTION TO AVOIDING OR REDUCING ENVIRONMENTAL AND SOCIAL COSTS	SUMMARY OF POTENTIAL CONTRIBUTION TO ENHANCING ACCESS TO ENVIRONMENTAL BENEFITS AND REDUCING SOCIO-ECONOMIC INEQUALITIES
			increasing crop management costs.		
REGULATORY	**Compensation measures**	The instrument has conditional potential to contribute to biodiversity, depending mainly on the type and extent of the damage being compensated. If implemented adequately and in combination with other instruments it can contribute to increasing area of habitat, habitat quality and connectivity. In such cases it can also promote ES supply in various contexts (urban, rural, peri-urban).	*May shift costs to other landscapes by allowing development/damage in the area being compensated for.*	Could create social inequities if funds for offsets are invested far from affected communities (social cost)	If compensation occurs locally, it can create jobs and improve access to green spaces for underserved communities, fostering equity
REGULATORY	**Performance-based approaches with point systems**	The instrument has good potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat. It can address habitat quality	*No concrete examples found in WP1. May incentivize higher upfront investments (e.g. developers willing to perform better - to secure*	Rewards higher environmental performance and encourages more equitable access to green spaces or sustainable designs but may exclude	

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		and connectivity if coupled with other instruments, where it can increase the supply usually in urban contexts.	*funding or to win public bids - need to increase green/blue surfaces, which requires better and costlier design planning?)*	smaller or underfunded actors unable to compete (social cost).	
REGULATORY	**Conservation zones, greenbelts, or protected areas and sites**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat and habitat quality. It can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts (urban, rural, peri-urban)	*Could shift economic activities (e.g., farming, construction) to other landscapes, potentially increasing development pressure in less-regulated zones.*	May limit local economic opportunities under current and established markets (farming, extraction, etc.) but improves quality of life for surrounding communities by providing recreational areas and preserving cultural landscapes, with the potential for new markets (sustainable tourism, etc.).	Increases access to natural spaces, improving mental and physical well-being. May conflict with available area for housing or other social development projects.
REGULATORY	**Land parcel ownership rearrangements**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat and connectivity. It can address habitat quality depending on management requirements after rearrangement and if coupled with	*Redistribution may impose administrative or legal costs on involved parties. Also, as seen in MeckPomm Arena, the requirements involved in the land readjustment (post-readjustment) may also impose additional financial*	Facilitates more efficient and sustainable land use, enhancing conservation opportunities and reducing habitat fragmentation. Potentially leads to social conflicts among stakeholders over land ownership; however, better land	If implemented with participatory processes and stakeholder engagement, it can address inequities in conservation planning by implementing adequate equity and compensation.

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		other instruments. In such cases it can increase the supply of ES in various contexts (urban, rural, peri-urban). However, the benefits of "Land Rearrangements" are often associated with reducing the number of very small rural properties and promoting the profitability of agricultural and forestry properties by increasing their average size. In these circumstances, increased mechanization and industrialization can lead to a significant reduction in biodiversity, as is happening in many parts of the planet.	*costs to the actors involved (e.g., need to comply with new farming practices, lack of know-how, increased cost in machinery, etc.)*	allocation may reduce inequality in land distribution.	
REGULATORY	**Land use zoning schemes in urban or rural spaces at different scales**	The instrument has good potential to contribute to safeguarding biodiversity by increasing area of habitat. It can address habitat quality and connectivity if coupled with other instruments. It can increase the supply of ES in various contexts,	*Shifts costs to sectors restricted by zoning limitations or requiring adjustments to align with zoning goals (e.g., businesses, construction firms). Affects the housing market. Evidence of its implementation with active involvement and*	Directs development away from sensitive areas, reduces social exposure to environmental hazards in residential areas (by limiting certain land-uses and activities). However, it may limit affordable housing or economic opportunities in restricted zones. It may also encourage development	Can help prevent industrial encroachment in cities, protecting communities from pollution; promotes mixed-use zoning for better access to services and jobs.

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		though it is usually applied more in urban spaces.	*engagement of various sectors - forestry, agriculture, energy, nature conservation - can help address these threats and contribute to better address biodiversity. (GDP Vittoria Gasteiz)*	displacement to other less-regulated landscapes in other jurisdictions. (social cost).	
PROJECT OR ACTION-BASED INSTRUMENTS	**Design-based instruments**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat and habitat quality. It can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts, but it is usually applied in urban (developed landscape) contexts.	*May shift maintenance and management costs to public institutions. Potentially impacting affordability for users (if intervened areas become restricted in access for example)*	Promotes sustainable urban designs. Enhances urban livability and aesthetics, benefiting residents' well-being; however, may lead to gentrification in specific urban areas and also increased costs may make housing or spaces less accessible for lower-income groups. The planning process needs to better control the real estate market (notably price and range of what is produced) and deal with the issues of inequalities and social injustice. There is potential for contribution but a good planning process may not be enough.	When implemented as a part of a dedicated program, the instrument can help to restore abandoned/neglected/marginalized neighborhoods, contributing to both biodiversity and social rehabilitation, as the example found in the URBINAT project (Portugal). It mainly contributes to reducing inequalities in access to green/public spaces and increases landscape aesthetics in often neglected/marginalized communities. Can address inequalities particularly if public participation is prioritized in the design process.

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PROJECT OR ACTION-BASED INSTRUMENTS	**Land acquisition**	The instrument has good potential to contribute to safeguarding biodiversity (area of habitat). It can address habitat quality and connectivity if coupled with other instruments. It can increase the supply of ES in various contexts, though it is usually applied more in urban spaces.	*Costs shifted to public entities or donors purchasing the land, with potential opportunity costs for alternative investments. This tool is mainly used by developed countries in direct negotiation with land owners in order to transfer the land to the public realm and avoiding private urban developments. 1st – not all the countries or local authorities have enough capital to buy the land (sometimes a strong public opinion supports it); 2nd – after acquisition the land requires care and management works, I.e., biodiversity protection don't stop with acquisition.*	Provides long-term public benefits through conservation but may disrupt local communities and livelihoods if not managed equitably.	Ensures long-term community benefits by securing land for public use or conservation, particularly in under-resourced areas

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PROJECT OR ACTION-BASED INSTRUMENTS	**Contractualizations, Partnerships and Stewardships, including Conservation Easements**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat and habitat quality. It can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts (urban, rural, peri-urban).	*Potential cost-sharing across actors, depending mostly on terms of contract, but also shifts costs to partners obligated to maintain stewardship responsibilities.*	Encourages community involvement and shared benefits, but may create uneven responsibilities or benefits among stakeholders	Promotes shared benefits and addresses inequalities if used to restore neglected or marginalized areas or if the terms of contract prioritize access for underserved communities or local resource use.
INFORMATION-BASED INSTRUMENTS	**Guidelines and criteria for public space design and management**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing by increasing area of habitat and habitat quality. It can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts (urban, rural, peri-urban).	*Could increase costs for public agencies needing to align with guidelines, or developers required to implement them. Its non-binding nature may hinder implementation if costs are too high or not compensated.*	Improves the environmental quality of public spaces, and can potentially enhance accessibility and inclusivity of public spaces, improving social cohesion; however, implementation costs may divert resources from other priorities.	Expands access to quality public spaces for all.

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INFORMATION-BASED INSTRUMENTS	**Guidelines for promoting good practices in private spaces**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing (area of habitat and habitat quality). It can address habitat connectivity if coupled with other instruments. It can increase the supply of ES in various contexts (urban, rural, peri-urban).	*Shifts costs to private landowners who may need to adopt sustainable practices at their expense. Its non-binding nature may hinder implementation if costs are too high or not compensated. The incorporation of guidelines for rural landscapes may help support positive market competition in the agriculture sector if coupled with E&FIs addressing the value chain - like green-label initiatives or green certificates*	Encourages sustainable land management on private properties. For example, guidelines for farming practices may contribute to decarbonization. Promotes equity in conservation efforts by involving private actors but may face resistance from landowners due to costs or perceived loss of autonomy.	Promotes environmental stewardship among private landowners, indirectly benefiting adjacent communities (potentially) by reducing local environmental hazards.
INFORMATION-BASED INSTRUMENTS	**Biodiversity monitoring & Ecosystems Services Assessments**	The instrument has conditional potential to contribute to biodiversity, depending on how they are designed and used to support decision-making. The choice of ES and condition indicators included in the assessment will determine its contribution to habitat quality and	*May shift costs to sectors funding assessments or entities managing land that requires continuous monitoring. Its non-binding nature may hinder*	If implemented early in planning processes, it helps identifying critical threats to ecosystems, guiding mitigation strategies that reduce long-term environmental and economic damages. It increases public awareness of biodiversity	If implemented with participatory processes and stakeholder engagement, it can address inequities in conservation planning, involving affected communities and ensuring their visions and concerns are translated in the ES assessment.

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		connectivity. It needs to be coupled with other SP&MIs instruments.	*implementation if costs are too high or not compensated.*	issues and supports informed decision-making.	
INCENTIVE-BASED INSTRUMENTS	**Density bonuses**	The instrument has conditional potential to contribute to biodiversity. It can support area of habitat if it increases net area (considering the development). It can contribute to habitat quality or connectivity depending on the criteria required and if coupled with other SP&MIs instruments. It may contribute to ES supply depending on the criteria required, usually only in urban contexts.	*May shift costs to other sectors as it potentiates higher demographic density in certain parts of the city.*	Encourages higher-density development in urban areas, reducing urban sprawl and preserving rural or natural landscapes (potentially reducing environmental and social costs related to urban transportation, for example). Promotes urban equity by linking bonuses to public (environmental) benefits, but poorly managed bonuses may lead to overcrowding or inadequate public services.	May encourage affordable housing options, reducing socio-economic inequalities
INCENTIVE-BASED INSTRUMENTS	**Transfer of development rights (TDR) mechanisms**	The instrument has great potential to contribute to safeguarding biodiversity and potentially enhancing it by increasing area of habitat and habitat quality. It can address habitat connectivity if	*Shifts costs to developers purchasing TDRs or landowners in sending areas who lose opportunities to develop their land. Its non-binding nature may hinder*	Preserves ecologically valuable lands by incentivizing development in less sensitive areas. Redirects development to areas that can reduce social and environmental costs of urban living (i.e., more	Redistributes economic benefits from urban development, benefiting rural or low-income communities in sending areas

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		coupled with other instruments. It can increase the supply of ES in urban contexts generally. It also allows for recovery and restoration interventions as in the Dutch example with the demolition of abandoned stables.	*implementation if such costs are too high or not compensated.*	accessible public transport). Provides financial compensation to sending area landowners, supporting local communities; however, may lead to uneven development in receiving areas.	
INCENTIVE-BASED INSTRUMENTS	**Fast-tracking approval process**	The instrument has conditional potential to contribute to biodiversity, depending on the type of greening interventions that are being rewarded. Should be coupled with other SP&MIs instruments especially to ensure habitat quality and connectivity, in which cases it can contribute to the supply of many ES. Contribution to area of habitat is dependent on net increase considering other developments included in the same project.	*May reduce costs for developers but shift administrative burdens and expedited review costs to regulatory agencies.*	Facilitates implementation of sustainable projects more quickly, reducing delays in achieving environmental benefits. May prioritize large actors able to demonstrate wider (larger) greening interventions over smaller or community-led projects.	By decreasing the bureaucratic burden of specific development projects, it can enable more affordable solutions (either in housing or other sectors), reducing socio-economic inequalities

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INCENTIVE-BASED INSTRUMENTS	**Interim use permits (abandoned/vacant lots)**	The instrument has good potential to contribute to safeguarding biodiversity by increasing area of habitat. It can address habitat quality and connectivity if coupled with other instruments. It can increase the supply of ES in various contexts, though it is usually applied more in urban spaces	*Could shift costs to community organizations or temporary users responsible for maintaining or enhancing the land during interim use. Its non-binding nature may hinder implementation if such costs are too high or not compensated.*	Reduces environmental risks from abandoned lots (e.g., illegal dumping), while creating temporary green infrastructure. In such cases it benefits biodiversity and mitigates urban heat and pollution, improving community safety and aesthetics, but may lead to conflicts over temporary uses or unclear long-term plans.	Provides communities with temporary recreational areas or urban gardens, potentially enhancing local well-being and food security.