BioValue

D1.2 Expert Perspectives of Integrating Biodiversity in Spatial Planning: Contributions from promising practices

WP 1 Spatial Planning and Management Instruments (SP&MI)
T 1.2 Innovative Spatial Planning and Policy Tools for Mainstreaming Biodiversity

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Executive Summary

The Biovalue project aims to promote transformative change in the integration of biodiversity and spatial planning. This is particularly relevant since reports from the OECD and IPBES have highlighted the significant impact of land use and cover change on biodiversity loss. In contrast, existing biodiversity strategies and policies have been siloed. Therefore, this report aims to provide key-learnings based on the identification and categorization of "Best Practices".

Best Practices are methods, techniques, or approaches that produce results generally accepted as superior. In public policy, Best Practices have been widely used to facilitate learning processes, whose transferability can promote improvements in other regions. However, applying this approach requires overcoming constraints such as demonstrating real effectiveness and accounting for context dependency. To address these challenges, Best Practices need to be understood as a discursive process that highlights the characteristics and conditions in which they were implemented. In spatial planning and biodiversity, both "substantive dimensions" and "procedural dimensions" are crucial for understanding the context of Best Practices.

To achieve a comprehensive and transferable understanding of Best Practices, this report adopts a methodological approach to identify Best Practices for integrating biodiversity into spatial planning and management. The framework leverages expert knowledge, gathers and organizes insights on Best Practices, and assesses their applicability in various contexts through three methodological steps: (1) collecting, (2) analyzing, and (3) structuring. The collecting phase involves two steps to gather examples of Best Practices: expert surveys and a systematic exploration of the Oppla repository. After compiling a list of 'Examples of Best Practices,' they were further investigated by establishing and applying criteria for analysis and conducting a lexical analysis. The structuring phase used insights from the analysis to inform frameworks for integrating biodiversity into spatial planning and management. This approach provides a nuanced understanding of diverse practices and the criteria that structure the "Best", offering valuable guidance for biodiversity integration efforts.

The discussion builds on the results of lexical analysis of the 56 BP identified which is aligned with predefined classification criteria placed against the backdrop of the planning process and the corresponding list of criteria arriving to the underlying dimensions supporting the best practices sample.

These practices expand knowledge on patterns that can drive transformative change in biodiversity planning. Key findings include the importance of integrating substantive and procedural dimensions and investing in the collection and dissemination of biodiversity information to foster public engagement and mobilization. Best Practices indicate that micro-scale Nature-Based Solutions, which can be managed by local populations, are valuable for increasing biodiversity awareness and creating networks of biodiversity spaces. The findings also show that biodiversity is not a niche issue and should be integrated with other environmental policies through an ecosystem approach. Valuing on-site actions within the broader ecosystem is essential for developing a Nature-Based Planning (NBP) culture.

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1. Introduction

The BioValue project aims to explore the transformative potential of Spatial Planning to safeguard and increase Biodiversity (BD). To address this issue, this report contributes to building knowledge by analyzing examples identified as Best Practices (BP) in showing significant or potential improvements in halting BD loss in the context of spatial planning.

Previously, in Task 1.1 of the BioValue project a framework was designed to scrutinize how BD has been integrated into the spatial planning process in a selected set of countries across spatial planning cultures, using BD as a specific case of environmental policy integration (EPI) as framed by Lafferty and Hovden (2003).

1.1 Setting the scene

The BD Convention (BDC) has consistently led to the development of BD policy instruments globally. Many European member states have already put nature conservation policies and practices in place. More recently, in 2023 the 15th COP meeting[1] outlined the Kunming-Montreal Global BD Framework "responding to the Global Assessment Report of BD and Ecosystem Services issued by the Intergovernmental Science-Policy Platform on BD and Ecosystem Services (IPBES), the fifth edition of the Global BD Outlook", and thereby aiming at halting and reversing BD loss. To reduce the threats to BD, TARGET 1 of the framework acknowledges the essential role of biodiversity-inclusive spatial planning, and urban-rural linkages[2].

Providing evidence for "Biodiversity-inclusive spatial planning" is at the core of the BioValue project to support further enhancement. It builds on the assumption that integrating BD in spatial planning improves substantively human well-being and contributes actively to sustainability transition.

In line with the CBD, the first European strategy for BD was officially adopted in 2000, when the European Union set a target to halt the loss of BD by the year 2010. At the heart of EU nature conservation policy are the Bird and Habitat Directives which, together, set the ground for the European Nature conservation network (Natura 2000). Also, the recently approved Nature Restoration Law[3] gives "priority to areas of habitat types that are not in good condition and that are located in Natura 2000 sites when putting in place restoration measures".

Against this backdrop, BD has experienced a rather siloed approach in the European policy landscape, disconnected from other policies, and spatially segregated as restricted to the Natura 2000 sites. In 2013 though, in the follow-up of the evaluation of the first European BD Strategy 2010, the European Strategy for Green Infrastructure Planning was innovative by reaching out to other policy sectors, as the Common Agriculture Policy, to ensure territorial continuity, linking Natura 2000 areas and the Regional Policy (ERDF) for funding. Green infrastructures, typically already present in many regions embedded in planning systems, with different kinds of naming (Monteiro et al. 2020) for instance ecological corridors, green networks, or ecological structures,

1 www.cbd.int/doc/c/f98d/390c/d25842dd39bd8dc3d7d2ae14/cop-15-17-en.pdf

[2] https://www.cbd.int/gbf/targets/1

[3] https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/759586/EPRS_ATA(2024)759586_EN.pdf

have gained new momentum, notably by reinforcing their multifunctionality and continuity, and the provision of ecosystem services. In their review, Monteiro and colleagues (2020) also refer to the emphasis on the role of GI "to promote sustainability and resilience at the local scale". Despite the encompassing nature of green infrastructures, poor systematic inclusion in the planning instruments (see findings in WP1.1 report) has been evidenced. Nevertheless, many initiatives and projects have been put in place, driven by public policy and public funding notably in the form of Nature-Based Solutions (NBS). NBS, as defined by the IUCN (Cohen-Shacham et al. 2016), are actions "that leverage nature and the power of healthy ecosystems to protect people, optimize infrastructure and safeguard a stable and biodiverse future". These have been high on the policy agenda also to address climate action by taking advantage of BD and natural processes to restore, sustain, and introduce ecosystem functions and foster the provision of ecosystem services. NBS are not necessarily integrated into the planning process and sometimes are seen as "fixes" for poor urban planning, embedded in single green space design and thereby possibly a "Dangerous distraction" (Frantzeskaki et al. 2019; Melanidis et al. 2022) from a more integrated, purposeful and multifunctional territorial approach.

Some of the public policies are linked to the private sector for eco-labeling and product branding purposes, or in the form of operational partnerships (for instance "Business and Biodiversity" programme).

1.1 “Best practices”: concept and limitations

BPs are sets of methods, techniques, or approaches that produce results that have been generally accepted as superior when compared to other known alternatives and that can be used as a benchmark (IPBES 2016). Sometimes these practices because of their success can become a standard to ensure a certain level of quality, for instance of a certain procedure.

BP research has widely been used in public policy, across policy fields (Vettoretto, 2009). Collecting and disseminating "BP" examples will contribute to a learning process that by transference can promote improvement in other regions (Bulkey 2006). For instance, EU regional policy has been guided by the concepts of "innovation" and "smartness", building on BP from well-performing regions. The challenge is that transference has been hampered by the "this one fits it all approach", based on an ideal model for innovation for all regions (Tödtling & Trippl 2005). Stead (2012) reports experiences from the spatial planning arena in syntony with Tödtling & Trippl (2005) arguing that there is no one "BP" policy approach that could be applied to any type of region. Nagorny-Koring (2019) referring to BP in climate action states that it is "usually taken for granted that the replication of BP examples can lead to a policy change. However, this assumption lacks empirical evidence, as BP features sticky and place-bound characteristics". The inefficiency of some transference exercises, for instance, the conservation strategies based on market-based instruments, which initially seemed very promising, has led to questioning the whole notion and the usefulness of the "BP" approach (Tödtling & Trippl 2005). Bretschneider et al. (2005) argue that as BP emerges from a comparative process, all alternatives need to be considered, to be able to use the term "best". Typically, BP research draws on a sampling exercise, selecting exemplar cases, making the process unreliable, depending on how the sample is selected and its context.

In summary, there is a triple-constrain in the identification of a "BP": firstly, knowing all the practices to be able to select the best; secondly, having a demonstration of the effectiveness and measured success of the practices across time; and thirdly, ensuring its capabilities to be "best" across contexts. All three create a high level of uncertainty due to a lack of knowledge.

1.2.1 The selection of the "best": the role of expert knowledge

The selection of the "Best" practice aggregates the first two constraints. It links to the limitation of knowledge of all practices, as well as to the limited access to information resulting from a monitoring process to effectively judge if the practice was indeed successful to be deemed the best. Experts have knowledge or "informed intuitions" based on their wide experience, which enables them to identify patterns and create mental schemata. These schemata are created for "explaining how we identify, categorize, understand and interpret events or objects" (Fridland & Stichter 2021). Hence, finding the right set of experts is crucial in identifying BP. Those who can compare amongst a wide selection of cases, know that they can evaluate against the pattern of action/effectiveness relation they have already encountered.

A way frequently used to deal with uncertainty derived from a lack of knowledge is expert elicitation (e.g. Werner et al. 2017). It has been used in both quantitative and qualitative research. In quantitative research, it is often used in the study of rare events and to collect structured elicitation of subjective probabilities (Swarzenegger et al. 2023). As a qualitative research method, it helps gather in-depth insights and knowledge from individuals with specialized expertise and authority in a specific field, sector, or topic. Elicitation of expert knowledge can take place in multiple forms: directly via elicitation of experts through questionnaires and/or interviews which are generally reported as tools for obtaining information from individuals (Harris and Brown 2010) or, indirectly, through systematic searches in a dedicated database. The methods yield potentially complementary results. Direct methods benefit from including an explicit expert judgment. Questionnaires are preferred for larger samples addressing a wide range of experts, responding for instance to an online questionnaire; while interviews more frequently applied to smaller sample sizes are more targeted at specific experts (Quinn-Patton 2002).

The quality of the outcome of expert elicitation depends strongly on the panel of experts selected. According to Drescher et al. (2013), there is a wide array of experts and expertise: ranging from expert scientists, who carry a more encompassing knowledge, to practitioners who became experts "through training and years of experience in applying their practical, technical or scientific knowledge to solve questions", encompassing a more local knowledge. Experts might be found in academia and research centers producing science, as well as in institutions where they practice producing empirical knowledge.

Expert knowledge has been used throughout a wide range of disciplinary fields (Caley et al. 2014) and, its successful use of expert elicitation depends strongly on the transparency of the selection of experts, its meaning embeddedness in the research design, and the systematical capture of evidences (Soest 2022).

1.2.2 Context dependency: towards transferability

When scouting for BP in BD actions and in spatial planning instruments the ecological and socio-cultural dimensions of the context need to be considered. From the ecological perspective, BP in an ecosystem (for example riparian) located in one biome might not be replicated in another, due to climate characteristics or species availability. Adaptations need to be considered notably through the identification of ecological equivalents across contexts, meaning for instance a species that plays the equivalent role (same function). The socio-cultural perspective refers to social norms and values, traditions and customs, legal frameworks or institutions, which need to be taken into account when aiming to transfer specific tools and mechanisms that might be not possible or acceptable to replicate.

Bulkey (2006) argues that BP can be better understood as a "discursive process", by making explicit the way it was produced, avoiding solely reference the new knowledge created and stripping the practice from its contextual characteristics (Vettoretto 2009). However, it is also recognized that the difficulty in conveying the full picture of BP. Stead (2012) refers to Wolman et al. (1994) who identified that "the less detailed an example of BP is, the less likely it will be that the example can be replicated elsewhere". This means that to improve replicability the understanding of each BP must be improved, notably by detailing the description of the original situation where the BP was developed/implemented.

Because BP are related to many types of characteristics and highly dependent on context, a systematic description benefits from the identification of *a priori* set of criteria to guide the portrayal of examples selected. These criteria establish analytical lenses.

Planning scale and geographical scope are fundamental to analyzing each BP. The planning scale has to do with the level of administration and decision-making (i.e., local, municipal, regional, or others). The geographic scope is mainly related to the geographic characteristics of the BP object, namely distinguishing urban from rural contexts. A criterion related to the ecosystem(s) focus - the identification of all types of ecosystems that are reported within the BP- is crucial in understanding the ecological context and its limitations.

Given the fact that the BP to be selected should report on the integration of biodiversity and spatial (or territorial) planning, it seemed relevant to consider a criterion reflecting how BP is situated concerning the various components of the planning process. Building on findings from BioValue Task 1.1 (Deliverable D1.1), the main planning components were already categorized as Vision, Strategies, Information baseline, Actions/Instruments/Regulations.

It is also considered pertinent to analyze whether BP occurs through integration into the formal planning process or whether it occurs through a parallel process, for example, involving civil society initiatives that develop outside of what is established. In Task 1.1, transformative change was already approached and is related to characteristics that define transformative adaptation in social, ecological, and socio-ecological systems. These are considered the main facets of transformative change adopted (see Deliverable D1.1).

The protection status of the area where the BP is implemented (e.g., when classifying national parks or environmental reserves) needs to be distinguished from those that occur outside that status because it shapes the existence of legal frameworks and funding available.

Another criterion considered is related to the triggering mechanism that has influenced each BP. Among scholars, it is widely accepted that policy mechanisms often rely on a triad consisting of rules, resources, and ideas which frequently operate together (Knill & Lehmkuhl, 2002; Börzel, 2003; Radaelli, 2004; Knill & Lenschow, 2005; Böhme & Waterhout, 2008). These elements can be distinguished as the metaphor of "stick," "carrot," and "sermon" and, in the context of EU policies, were originally used by Vedung (1998) to describe such mechanisms, an analogy that was later supported by Purkarthofer (2018) and David et al. (2024).

The perceived complexity of implementation seems also to be an important aspect to report on the BP. The time and size that characterize the implementation of the BP are expected to influence its replication to the sheer number of interactions requested for its implementation. Complexity (in the context of territory and cities) is related to several aspects namely the number of elements and relationships, or connectivity, as mentioned by Salingaros (2005), and also by the set of complexity mechanisms (redundancy, feedback, etc.) in place. As also the way the actors involved in each BP interact within a given governance mode. Despite multiple perspectives on governance types and arrangements, as reviewed and discussed by Monteiro (2017) this criterion aims to distinguish BPs led by the government, non-government-led BP, and BP using a co-governance mode, specifically involving private entities. Ultimately, the criterion on the beneficiaries needs to distinguish BPs where all private and public users benefit from those where only private users benefit.

These criteria can be structured according to two dimensions: "substantive dimensions" and the "procedural dimensions". In the planning practice it means that both dimensions need to be disentangled and made explicit (Faludi in AESOP 2015[4]). Substantive dimensions report on the object of concern. Whereas "procedural" or "instrumental" dimensions address the mode of planning and the tools deployed (Alexander, 1992). Both are interdependent and need to be observed jointly in the identification of BP.

4 https://api.aesop-planning.eu/server/api/core/bitstreams/794a4806-dac4-4d05-a2b9-bd66defoa8c6/content

2. Methodology

A methodological approach is developed to identify BP for integrating BD into spatial planning and management. It aims to leverage expert knowledge, gather and organize insights on BP, and discuss the underlying dimension that can support BD in various contexts. This approach is structured in three phases: (1) collecting, (2) analyzing, and (3) structuring (Figure 1).

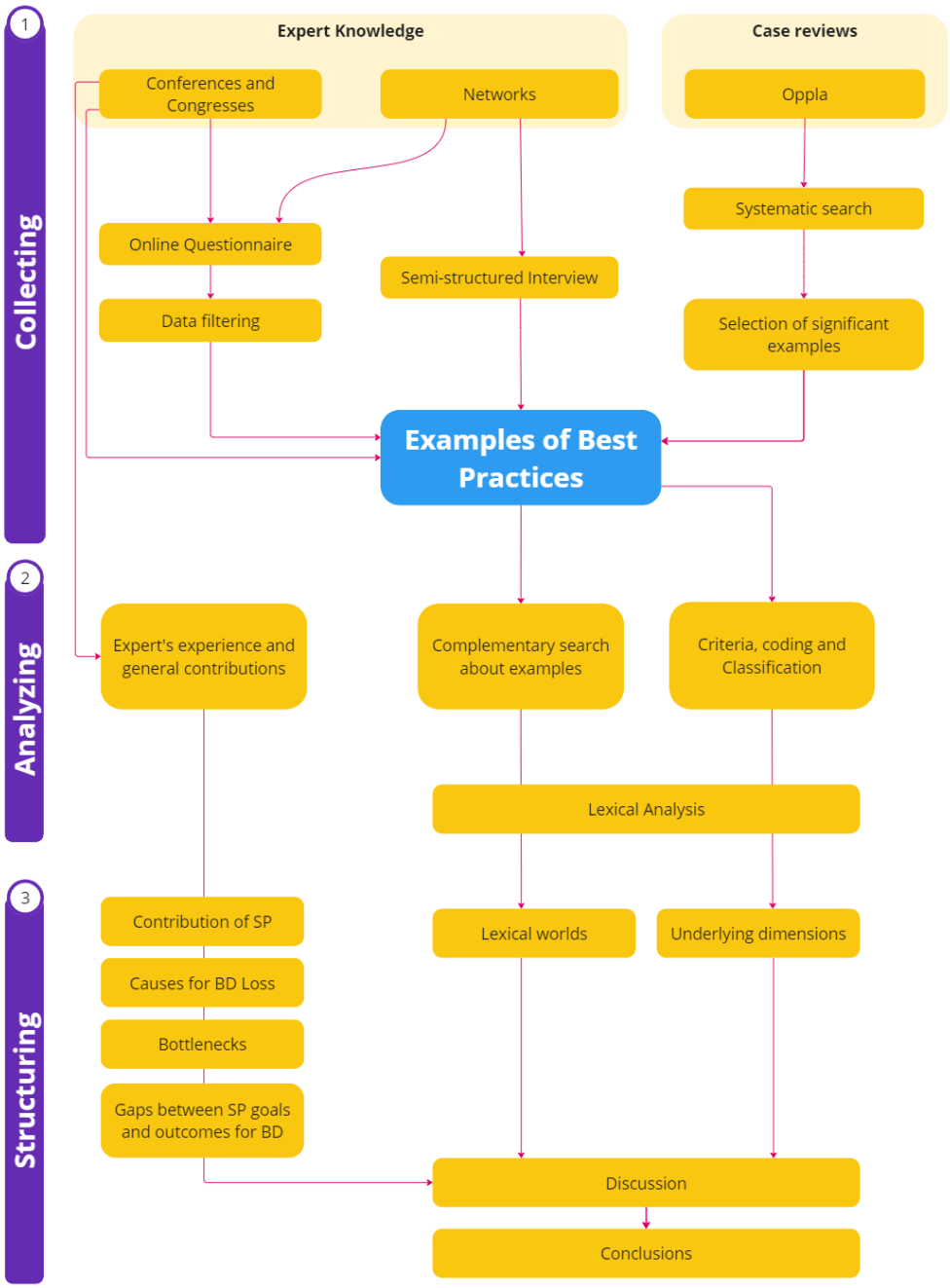

Figure 1: Outline of methodology

The collecting phase (1) involves two steps to gather examples of BP: first step using questionnaires and interviews with experts; and a second step, involving a systematic exploration of the Oppla repository, an open and collaborative platform connecting scientific, policy, and practical communities focused on Natural Capital, Ecosystem Services, and Nature-Based Solutions.

After compiling that list of Examples of BP (see Figure 1) from expert knowledge and case reviews, the analyzing phase (2) investigates the data in two steps: a first, extracting original textual data describing each example from the source, and a second, establishing and applying criteria for analyzing BP through a coding system. Results from these procedures were used as input for lexical analysis through the Alceste method (Reinert, 1998), a well-established approach in linguistics and social sciences research, especially when dealing with a substantial volume of spoken or written material.

Supported by multivariate statistical techniques, the method enabled the identification of patterns and themes across examples, either obtained from expert knowledge or case reviews, facilitating the exploration of complex relationships between different 'lexical worlds' and 'underlying dimensions' within the sample. This approach allows for a nuanced understanding of the diverse practices and the criteria that structure BP. Consequently, it provides insights into potential frameworks that can inform the integration of BD into spatial planning and management, as discussed in section 3 (structuring).

3. Collecting

The collecting phase included two types of sources. The survey of expert knowledge through questionnaires and interviews, and case reviews by systematic search in the Oppla repository.

3.1 Expert Knowledge

The experts were reached considering two assumptions: they gather in high-level international events on the topic, or they are members of specialized networks. There is a limited access to reach experts holding knowledge concerning both BD and spatial planning. Thus, networks and events were scouted focused on policy and practice in BD and spatial planning as well as fields related, such as policy advisory, ecosystem services, sustainability, or landscape architecture. The experts were tagged in two ways: (1) Conferences; and (2) Networks of practitioners. The BioValue team purposefully attended events and contacted dedicated networks for data collection.

The methods for surveying were: On-line questionnaires and semi-structured interviews. In quantitative research, questionnaires and interviews are generally reported together as tools for obtaining information from individuals (Harris and Brown 2010). Semi-structured interviews are flexible methods for clarifying and complementing information since they are based on a few general questions and/or topics that allow emergent sub-questions according to the answers of the participant (Quinn-Patton 2002). For this research, questionnaires were distributed in the conference setting taking advantage of the high influx of participants, and distributed to the networks by email. Semi-structured interviews were used to survey experts signaled by the networks. since they were recognized as experts with the potential to provide more information.

Conferences

From March to July members of the BioValue team participated in 7 conferences (Table 1) as speakers or participants. In these roles, they used multiple strategies to attract the participant's attention. When the members of the BioValue team were speakers, they included a brief presentation of the project in their communications. Sometimes those presentations were complemented using a participative software called MentiMeter for collecting information about the participants and conducting them on the topics of the survey (Figure 2). In some communications at conferences where there were conditions for greater interaction with participants, a QR code was presented with a link to the questionnaire. In two of the conferences (AESOP and IALE), BioValue hosted a session in which promoted more active participation of the public.

Table 1: Conference attendance for distributing the survey among experts

Event	Place	Distribution	Month
45th Congress of INTA – International Urban Development Association	Oeiras - Portugal	Presentation+ 75 stripes	March 23
3th Congress of ICOUL - Congreso Internacional de Paisaje Urbano	Barcelona - Spain	35 stripes	March 23
NetworkNature Annual Event	Brussels - Belgium	100 bookmarks	June 23
European Urban Research Association Conference in Reykjavík	Reykjavik – Iceland	Presentation+ 40 bookmarks	June 23
Green Deal Net	Lisbon - Portugal	30 bookmarks	June 23
11th IALE World Congress – International Association for Landscape Ecology	Nairobi - Kenya	Presentation+ 80 bookmarks	July 23
AESOP Annual Congress – Association of European Schools of Planning	Lodz – Poland	Presentation+ 80 bookmarks	July 23
Nature-Based Solutions Summit	Porto - Portugal	Presentation	May 24

Figure 2: Questionnaire distribution: MentiMeter for introducing questionnaire and Bookmark prototype and distribution.

In addition to the presentation, it was distributed 350 bookmarks with the information of the questionnaire. When members of the BioValue team were speakers, the bookmarks were distributed in the same room, as well as in other rooms of the conference. When the members of the BioValue team were participants, the bookmarks were extensively distributed to the public with the permission of the organizers.

In the case of the NBS Summit in Porto, task 1.2 was presented in a communication of the BioValue team. In the section on comments and debate, one of the attendees contributed an example of BP.

Networks

From August to November the members of Work Package 1 from the side of IST-ID contacted 17 networks (Table 2) in areas related to the aforementioned fields to improve the sample of BP examples. First, all networks received the link to the questionnaire via email to distribute among their members. Then, they were contacted and invited to an online interview.

Table 2: List of networks contacted

Actor	Acronym
European Council of Spatial Planners – Conseil Européen des Urbanistes	ECTP-CEU
International Society of City and Regional Planners	ISOCARP
Association of European Schools of Planning	AESOP
International Urban Development Association	INTA
Ecosystem Services Partnership	ESP
International Federation of Landscape Architects - Europe	IFLA Europe
European Spatial Planning Observation Network	ESPON EGTC
Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services	IPBES
International Association for Landscape Ecology	IALE
Natural Capital Coalition	NCC
Society for Ecological Restoration	SER
Toolkit for Ecosystem Service Site-Based Assessment	TESSA
The Nature Conservancy	TNC
International Union for Conservancy of Nature	IUCN
Global Landscape Forum	GLF
Associação Naturza Portugal	ANP/WWF
The Nature Conservancy	TNC
European Urban Research Association	EURA
Red Universitaria Iberoamericana de Territorio y Movilidad	Ruitem
Iniciativa Latinoamericana del Paisaje LALI	LALI
Green Deal Net	Green Deal Net
Uniscape	Uniscape

On-line questionnaire

The questionnaire (see Appendix A) was designed to be concise and minimize participant time commitment. It consists of ten questions: five close-ended and five open-ended. The first question serves as an introduction to focus respondents on spatial planning and BD loss topics, followed by inquiries into BP examples and their justifications. The remaining questions gather background information and contact details from respondents, inquire about their outreach professional experience, and seek consent regarding data management.

Data filtering

The first step for extracting the BP examples in the questionnaires was unifying the results of the 28 completed questionnaires. With the compiled results, the examples were screened having as the main criteria the direct reference to spatial planning and management instruments in each BP. The questionnaires in which the respondent left the question of the BP example blank were immediately removed, and others in which the information was vague for achieving the goals of the task were classified as noise data and removed.

Semi-structured Interview

The interview (Appendix B) is composed of eight topics that were intended to cover the personal experience of the interviewee and the network he belongs to, the references of BP examples, and general questions about the integrations of BD and spatial planning. In the first topic, it is asked the background of the interviewee. The second topic is related to the main causes of BD loss. The third and fourth topics relate BD with spatial planning by asking about the experience of the network in those fields and the bottlenecks. The fifth topic uses the bottlenecks as a counterexample for asking the reference of the BP example where effective integration was observed. The sixth and seventh topics are optional for the interviewees with more expertise in planning tools and asked about the main gaps for integrating BD and spatial planning alluding to specific parts/moments and scales of the spatial planning process in which that integration happens. The eighth topic asked for recommendations to better integrate BD and spatial planning.

3.2 Case reviews (Oppla)

Oppla[5] serves as an open and collaborative platform connecting scientific, policy, and practical communities worldwide, focusing on Natural Capital, Ecosystem Services, and Nature-Based Solutions. Functioning as a knowledge hub, Oppla facilitates access to research findings for both environmental and broader audiences. Notably, it offers resources such as a tool for locating case studies (Faivre et al., 2017). Therefore, Oppla was utilized as a repository for case reviews. The selection process involved three systematic steps to identify relevant cases from the platform.

Systematic search

The Oppla platform hosts 543 case studies globally, which were systematically filtered based on relevance to the task's scope using predefined criteria related to scale and case type (Figure 2). The search involved two sequential steps aimed at narrowing down the sample based on impact scale and thematic relevance. Initially, cases categorized as having local or subnational impact were selected. The decision to select case studies at the local (municipal) and subnational (regional) scales is based on the critical role these levels play in driving land use-related policy changes affecting biodiversity and ecosystem services (Beery et al., 2016; Cortinovis & Geneletti, 2018). The case type criterion remained open, encompassing potential examples from Natural Capital and Ecosystem Services Case Studies, Nature-Based Solutions Project Case Studies, and City Overview

[5] http://Oppla.eu/

Case Studies. Consequently, the search query used was [scale=local + subnational] AND [type=null], resulting in 133 cases.

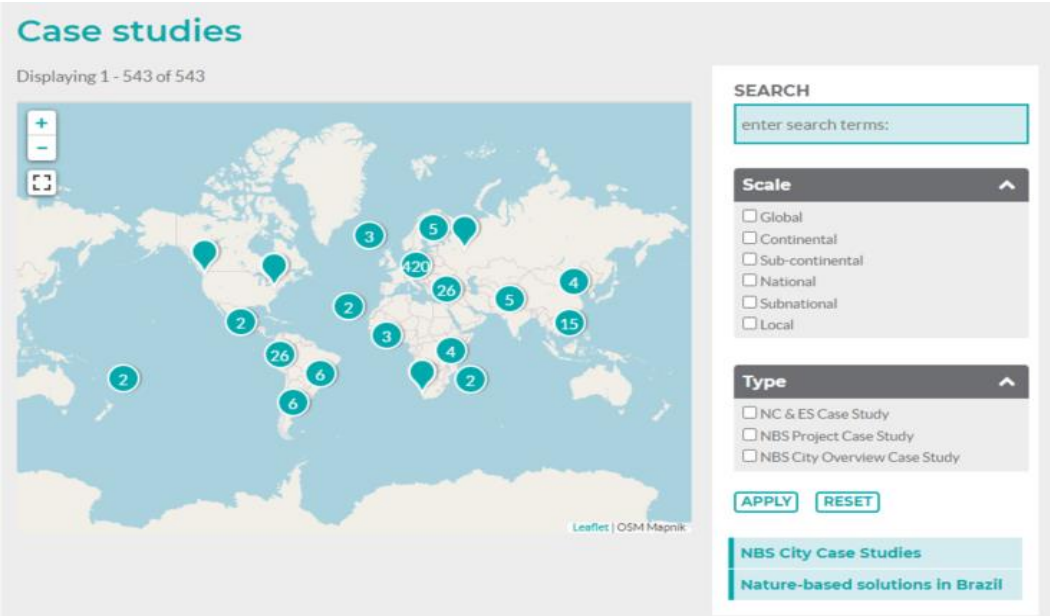

Figure 3: Oppla's search engine

Each case study on Oppla includes a concise summary outlining its objectives, outcomes, and lessons learned, typically within 1000 characters. To conduct a more detailed review, the second step consolidated these descriptions into a single document and conducted a keyword search focused on relevant topics for the task. Oppla's thematic focus on environmental case studies necessitated prioritizing "Planning" as a primary keyword, complemented by biodiversity-related terms. Therefore, the search query employed was [Planning] AND [Biodiversity OR Conservation OR Ecosystem OR Forest OR Environment]. This approach yielded a refined selection of 56 cases.

Selection of significant examples

The selection of significant BP examples involved analyzing a diverse range of cases from Oppla, incorporating both structured and unstructured data. Managing a large volume of written material required meticulous methodological planning. To streamline this process, a final step focused on identifying the most significant examples based on their lexical characteristics while selecting them for an in-depth analysis. This included employing the Alceste method of lexical analysis (further developed in Chapter 3) on the 56 Oppla examples. Hierarchical Descendant Classification (DHC) was utilized to categorize these examples into distinct lexical classes, ranking them according to frequency and statistical measures such as chi-squared and p-values. The selection of significant cases considered the contribution of each class in the DHC, with BP examples extracted based on their ranked statistical significance (chi-squared values with p-values < 0.0001) (see Supplementary_Material_Del1.2_Raw Data for details).

3.3 Examples of Best Practices

The second phase builds upon the information derived in the collecting phase previously presented. After obtaining a final sample of 58 cases (20 from Oppla case reviews plus 38 from expert knowledge) (Table 3).

Table 3: Acronyms of the BP

#	Best practice	#	Best practice
BP1	Rotterdam - NbS for building a waterproof city	BP33	"Healthy Corridors" URBiNAT consortium. The questionnaire mentioned 'Oporto NBS corridor'
BP2	London - NbS for a leading sustainable city	BP34	BIODIVERSITY MONITOR – Towards a Biodiversity Monitor for Dairy Farming
BP3	Green Roof and Water Management in Philippines Government Office Building	BP35	The Toolkit for Ecosystem Service Site-based Assessment - TESSA
BP4	Amsterdam - NbS for greening the city and increasing resilience	BP36	Environmental Rural Registry' (CAR): Brazilian legal framework for registration of rural properties
BP5	Rotterdam: From urban challenges to place-based visions - Climate proofing the city	BP37	Bridge: Building River Dialogue and Governance
BP6	Transition Planning - Parco Agricolo	BP38	Serious games
BP7	Participatory Reconversion Workshop	BP39	Biodiversity Net Gain
BP8	Berlin - NbS for urban green connectivity and biodiversity	BP40	The Greenwich Millenium Village
BP9	Planning with Green Infrastructure	BP41	Friends of Portbury Wharf
BP10	Bristol - NbS for ensuring a sustainable future	BP42	Cranbrook
BP11	Szeged - NbS for urban regeneration and adaptation to climate change	BP43	Corona Verde (green crown)
BP12	Ljubljana: NbS for Urban Regeneration and Wellbeing	BP44	National Strategies for 'Land Saving' and 'Targets for Reducing Land Use' within the German SD Strategy
BP13	Park Spoor Noord, Antwerp	BP45	Bristol Good Food 2030
BP14	Optimising ecosystem service delivery: what to do where to gain best bang for buck	BP46	ESPON-SUPER (Sustainable Urbanization and land-use Practices in European Regions)
BP15	Edinburgh - NbS enhancing health, wealth and sustainability	BP47	Luas cross city - landscape Strategy
BP16	Community Interest Company Barking Riverside	BP48	City of Calgary, Alberta
BP17	Genk - NbS bridging green and industrial heritage	BP49	Dehcho First Nations

BP18	Dublin - NbS for a more sustainable city by 2030	BP50	City of Edmonton, Alberta
BP19	Landscape and Recreation Value Trade	BP51	City of Greater Sudbury (Northern Ontario)
BP20	Cultural seascapes: Social-cultural valuation of ecosystem services in Fingal, County Dublin, Ireland	BP52	City of Guelph, Ontario
BP21	Biodivercities project	BP53	City of Kelowna, British Columbia
BP22	The old railway track circuit in New York	BP54	Montréal, Quebec
BP23	No net land taken by 2050	BP55	City of Toronto, Ontario
BP24	Green Corridor Alcantara	BP56	City of Trois-Rivières, Québec
BP25	Green Corridors in Lisbon	BP57	City of Winnipeg, Manitoba
BP26	Tamera	BP58	Town of Wolfville, Nova Scotia
BP27	DOTSE. Directrices de Ordenación de Ámbito Supraregional de Segovia y Entorno		
BP28	DOTVAENT		
BP29	Plan Regional Valle Del Duero		
BP30	UNEP Programme in Afghanistan		
BP31	World Heritage 'No-Go' Commitment (the questionnaire only mentioned 'no-go zones)		
BP32	Green Belt in Victoria Gasteiz		

4. Analyzing

In this chapter, we describe the analytical process that is carried out using the collected data, which helped to characterize the BP sample obtained from expert knowledge and case reviews. While not providing results, the analysis enabled us to understand the expert's profiles in terms of their experience and background, as well as their overall contributions to the BP sample. Additional analysis processes needed to characterize the sample obtained are also described. These were a crucial step for creating the textual corpus required for the lexical analysis of all cases. In addition, a description of the criteria, the coding, and the classification processes is provided, an essential stage for applying the Alceste method of lexical analysis.

4.1 Characterization of expert's experience and general contributions

We tailored questions to assess professionals' expertise based on their knowledge fields and backgrounds. The way questions were posed varied depending on whether the expert was approached via questionnaire or interview. Of all the contacts made, 16 participants responded to the questionnaire with completed responses, and five were interviewed (Table 3). The questionnaire was centered on the expert's areas of activity, while the semi-structured interviews allowed for a more in-depth exploration of their professional and academic backgrounds.

Questionnaire

Most professionals declare to be involved in the Environment (69%) and Planning disciplines (56%), followed by Landscape Architecture (31%). Urbanism was mentioned 25% of the time as a current area of focus. Agriculture and Education were also mentioned in the same proportion. Architecture, Policymaking, Management, and 'others' were mentioned 19% of the time as their current domains. Economics was declared 6% as a current area of expertise (Figure 1).

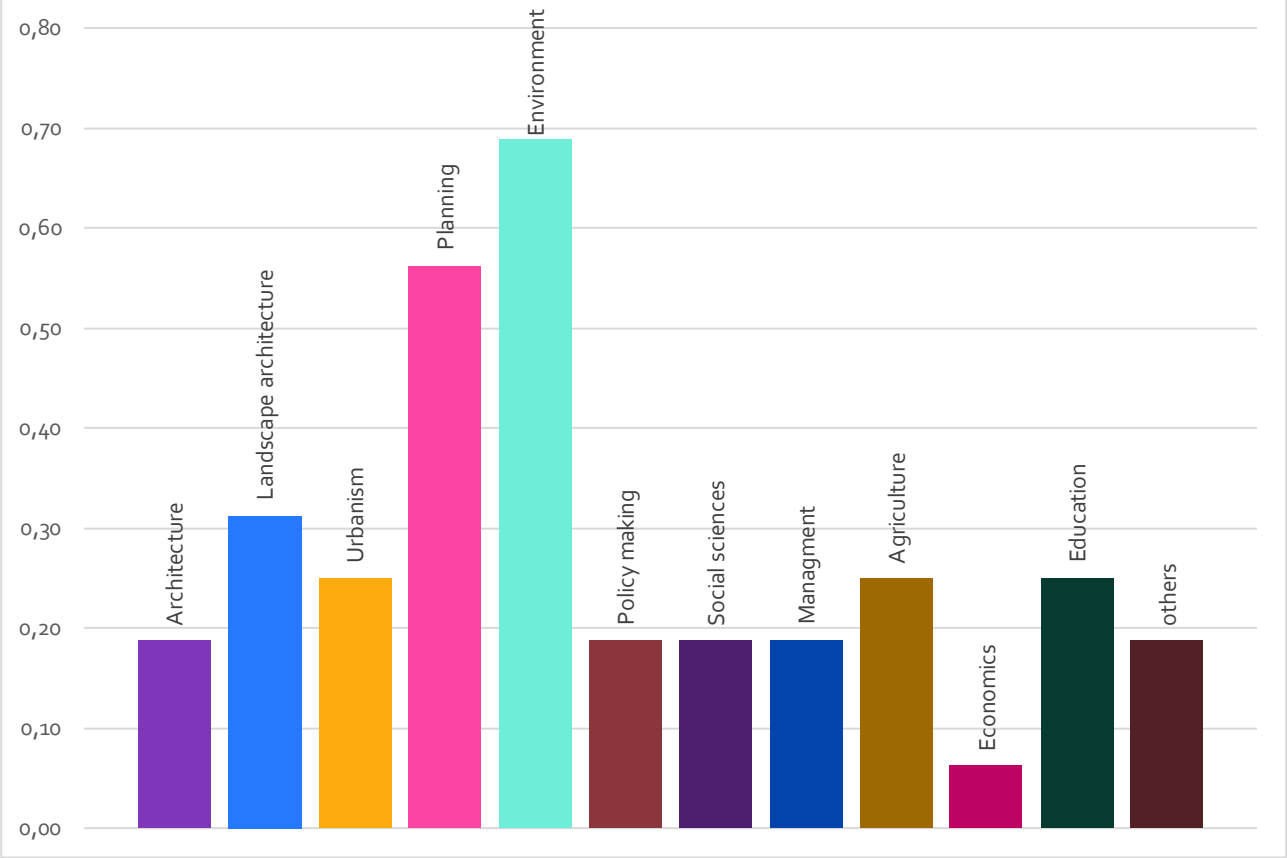

Figure 5: Expert's fields of activity.

Alongside consultancy firms, experts are primarily involved in educational activities within universities and research centers, with 44% indicating their engagement with those. Private companies and non-governmental organizations (NGOs) were cited less frequently, accounting for 19% and 13% respectively. Only 6% of the respondents identified other types of organizations were they carry out primary activity. It should be noted, however, that some individuals declared working with more than one type of organization (Figure 6).

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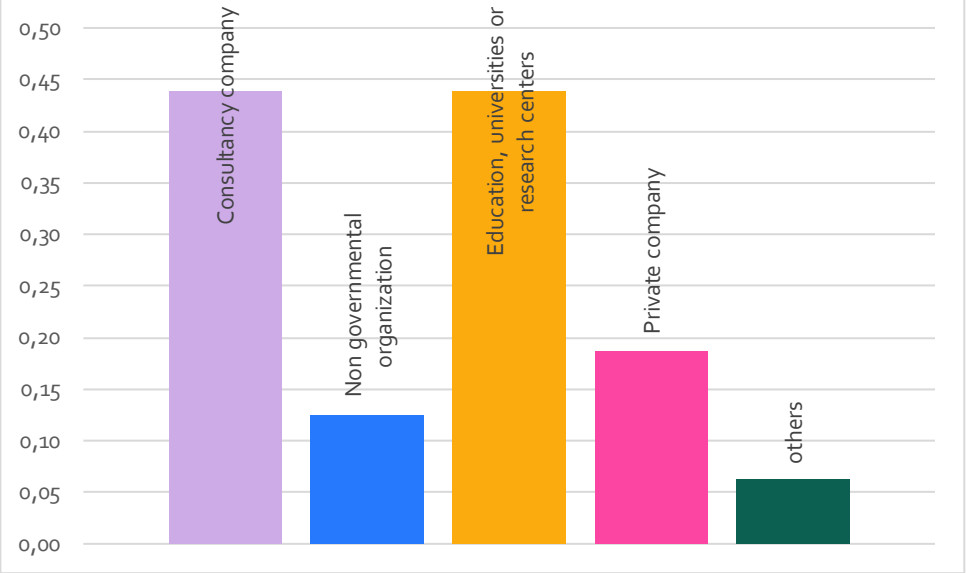

Figure 6: The type of organizations that experts are involved with.

Interview

Although the number of participants was limited, the interviews offered a chance for in-depth conversations regarding professional and academic experiences. The secretariats of each network recommended knowledgeable professionals during the initial contact, resulting in interviews with active members of Birdlife International, EURA, AESOP, ECTP-CEU, and IFLA.

Birdlife International is a global partnership of over 100 national conservation organizations focused on bird conservation. They collaborate to share priorities, programs, and actions to conserve BD. A sizeable grassroots membership supports the partnership and has a decentralized secretariat coordinating activities and services. Together, they form a powerful global conservation movement working locally and globally. Stefano Barchiesi, the interviewee, works in the Ecosystem Service division. His primary focus is the study of wetlands and water programs in collaboration with the IUCN. In the domain of ecosystem services and planning, Stefano has bee n actively involved in developing a platform called TESSA, a toolkit designed to evaluate ecosystem services. It targets users across all terrestrial and wetland habitats and aims at developing and developed countries.

EURA is a network of scholars that covers different fields of urban studies, from political science to urban design and planning, aiming to bridge research and policy. Danielle Sinnet, the interviewee, is a Professor at the University of the West of England, where she serves as the Director of the Centre for Sustainable Planning and Environments and a Professor in Sustainable Built Environments. His area of expertise lies in social sciences related to planning, focusing on integrating zoning for BD, building with nature for sustainable development, and translating these concepts into policy frameworks. The interviewee emphasized the importance of BD and how it should be regarded as a planning issue, a goal to which EURA can contribute.

AESOP represents planning schools across Europe and works to improve planning education and qualifications for spatial planners. The organization collaborates with other professionals and

stakeholders using its expertise in ongoing discussions and initiatives to ensure that planning education meets high standards regarding spatial planning, urban development, and management. Giancarlo Cotella is an architect with a Ph.D. in Spatial Planning. He currently serves as the Secretary-General of AESOP and is an associate professor in Spatial Planning at Politecnico di Torino. His primary research focuses on comparative studies of spatial planning systems and practices across Europe, with a specific interest in formal and informal European planning institutions, particularly Territorial Cohesion as an informal spatial planning tool in response to the EU's lack of competencies in formal Spatial Planning. According to the interviewee, although BD is not a specific research topic, AESOP's thematic groups, such as 'Resilience and Risk Mitigation' and 'Sustainable Food Planning,' can significantly deepen scientific knowledge about BD and spatial planning.

ECTP-CEU is a non-profit umbrella association of 28 professional spatial planning associations and institutes from 24 European countries, aiming to promote the visibility and recognition of spatial planning and urban development in Europe. The association engages in dialogue to set standards of conduct and education for spatial planners. The interviewee, Henk Van der Kamp, has been a Tow-Planner and Secretary-General since 2022.

IFLA aims to promote the highest standards of education and professional practice across all aspects of landscape architecture, including planning, design, ecology, BD, management, maintenance, culture, conservation, and socioeconomics. Tony Williams, the interviewee, is a Senior Landscape Architect and past President of IFLA-Europe. His scientific research focuses on the impediments to implementing Nature-Based Solutions. His background has been related to project development, designing and constructing transport infrastructures such as motorways and roads, assessing the landscape character of urban, peri-urban, and rural areas, analyzing landscape impacts, and designing mitigation strategies for major and minor infrastructure projects.

4.2 Complementary search for the examples of BP

The BPs mentioned by the experts, during the interviews and filling out the questionnaires, required additional research as their description was often scattered across multiple sources. Also, the description and characterization of the BP presented by the Oppla platform are not always sufficiently structured and unified in a single document.

The complementary research aimed to guarantee the presence of original information and/or data that related to the analysis concerns, expressed through the various criteria presented in Chapter 2 and further developed in Chapter 5. For this reason, it was necessary to systematically extract the original text describing each BP, from different sources, and organize this text so that it could be analyzed in subsequent phases, particularly through lexical analysis methodologies. The selected original text, covering whenever possible the various criteria stated in Chapter 1, was organized on a form for each BP. These various forms are presented in the see Supplementary material B_Del1.2_BP_Form of this deliverable.

4.3 Criteria, Coding and Classification

Criteria definition and coding

To obtain a reliable comparative analysis among all the BP examples, it was decided to identify criteria that responded to the characteristic of the examples according to the information provided in the complementary research. As mentioned in Chapter 1 the identification of the criteria that guided the in-depth analysis, takes into account procedural dimensions, and substantive dimensions.

These criteria were subsequently organized according to the following sub-dimensions: Whom - BP for whom?; How - how did each BP happen?; Who - who performs this BPs?; Why - BP why?; What - what is the purpose of this BP? (Table 4).

A coding system was put in place for each criterion in order to highlight aspects pointed out in Chapter 1. These aspects are considered 'a priori' important for understanding each BP, and for further use in the lexical analysis.

Coding is depending on the existence of detailed information. Using the example above, this means that a given BP can be described as having practices that are integrated in the formal planning system (fi_1) or having reported both situations (fi_12). In all the cases code 0 cannot be concatenated with the other codes, precisely because code 0 means that, by any reason, the criteria is 'not applicable' to the given BP or there is not information to support the codification.

Table 4: List of criteria and coding

Dimensions	Sub-dimensions	criteria		Acronym	Coding	code	example
processual	where?	c1	Planning components	pc	"Not applicable" or "No information"	0	pc_0
					Vision	1	pc_1
					Strategy	2	pc_2
					Information Baseline	3	pc_3
					AIR (Actions, Planning Instruments, Regulations)	4	pc_4
		c2	Integration in formal planning processs	fi	"Not applicable" or "No information"	0	fi_0
					Integrated	1	fi_1
					Paralell	2	fi_2
	how?	c3	Protection status	ps	"Not applicable" or "No information"	0	ps_0
					Protected (Classified as such: Parks, reserves,...)	1	ps_1
					Not protected	2	ps_2
		c4	Triggering mechanisms	tm	"Not applicable" or "No information"	0	tm_0
					stick	1	tm_1
					carrot	2	tm_2
					sermon	3	tm_3
		c5	Complexity of implementation	ci	"Not applicable" or "No information"	0	ci_0
					low complexity	1	ci_1
					medium complexity	2	ci_2
					high complexity	3	ci_3
	who/whom? Boas páticas para quem?	c6	Governance mode	gm	"Not applicable" or "No information"	0	gm_0
					Government led	1	gm_1
					Co-governance	2	gm_2
					Non government led approaches	3	gm_3
		c7	Beneficiaries	bf	"Not applicable" or "No information"	0	bf_0
					all (public users)	1	bf_1
					restricted (e.g., private users)	2	bf_2
	why?	c8	Transformative capacity	tc	"Not applicable" or "No information"	0	tc_0
					restructuring	1	tc_1
					path-shifting	2	tc_2
					innovation	3	tc_3
					multi-scale	4	tc_4
substantive	what?	c9	Ecosystem focus	ef	"Not applicable" or "No information"	0	ef_0
					Marine	X	ef_M
					Freshwater (rivers & streams, lakes & ponds, wetlands, estuaries)	1	ef_F
					River	2	ef_F1
					Lake	3	ef_F2
					Wetland	4	ef_F3
					Terrestrial	5	ef_T
					Forest	6	ef_T1
					Desert (hot & dry, semi-arid, coastal, cold)	7	ef_T2
					Grassland (temperate, savannas, steppes, pampas)	8	ef_T3
					Mountain	9	ef_T4
		c10	Scale	sc	"Not applicable" or "No information"	0	sc_0
					local	1	sc_1
					municipal	2	sc_2
					intermunicipal	3	sc_3
					regional	4	sc_4
					national	5	sc_5
					european	6	sc_6
					global	7	sc_7
		c11	Scope	scp	Not applicable or "No information"	0	scp_0
					urban	1	scp_1
					peri-urban	2	scp_2
					rural (e.g., agriculture, forest)	3	scp_3
					other (mining, industrial area, port area, infrastructures, etc...)	4	scp_4

The criteria used (see Chapter 1) are described below, making the reference to the coding that are relevant for the lexical analysis.

C1 – Planning components (pc)

Spatial planning components, following findings of in Deliverable D1.1, were organized according to 4 possible codes, which can be concatenated if more than one situation occurred (ex: pc_134). Knowing which Planning Components were most mobilized or most focused in each of the BP analyzed, and how they relate to other criteria, seemed to be important for the analysis and conclusion-making process

- "Not applicable" or "No information" (pc_0)
- Vision (pc_1) – visions provide a common general view for the long-term future of an area, which derives from political choices, social desires, and/or linked to international and European policy frameworks.
- Strategies (pc_2) – The strategies are statements of specific qualitative and quantifiable objectives and targets the Plan set to implement the visions.
- Information Baseline (pc_3) – The information baseline represents the knowledge background, built upon the analysis of current and future conditions, that supports planning decisions.
- Actions/ Instruments/ Regulations (pc_4) – The actions/regulations/instruments/ are used to implement planning strategies in order to achieve the planning visions.

C2 - Integration in formal planning process (fi)

This criterion is intended to identify BP whose actions are fully integrated into the formal planning system as established in each case ("Integrated"). If they refer to civil society or stakeholder initiatives that are clearly developed through, for example, cooperation actions, without the need to be integrated into formal planning schemes, they should be classified as "parallel".

- "Not applicable" or "No information" (fi=0)
- Integrated (fi=1)
- Parallel (fi=2)

C3 - Protection status (ps)

If the good practice is reported as occurring in areas already formally classified or already having some type of legal protection (whether on a local/municipal scale or on a national or supranational scale) and it is unlikely to change this status (like the case of National Parks, Ecological Reserves, etc.), the BP must then be classified as "protected". In the case of plans that classify land use, the "not_protected" classification must be adopted as this type of classification may not be sufficiently robust and definitive. "Not applicable" refers to non-territorial BP like information base line.

- "Not applicable" or "No information" (ps=0)
- Protected (ps=1)
- Not protected (ps=2)

C4 - Triggering mechanisms (tm)

Among scholars, it is widely accepted that policy mechanisms often rely on a triad consisting of rules, resources, and ideas, and though these elements can be distinguished conceptually, they frequently operate together (Knill & Lehmkuhl, 2002; Börzel, 2003; Radaelli, 2004; Knill & Lenschow, 2005; Böhme & Waterhout, 2008). The metaphor of "stick," "carrot," and "sermon" in the context of EU policies was originally used by Vedung (1998, p. 29) to describe such mechanisms, an analogy that was later supported by Purkarthofer (2018) and David et al. (2024). In the EU policy context, the "stick" metaphor pertains to policy mechanisms based on compulsory instruments and legislation, which domestic planning systems must adhere to (e.g., EU or National environmental legislation). The "carrot" represents economic or financial incentives and is closely linked to

opportunity cost, where the prospect of receiving funding motivates actions, projects, plans, or policies. By presenting financial incentives, stakeholders are encouraged to pursue biodiversity-friendly practices, capitalizing on available economic resources (e.g., EU or domestic funds). The "sermon" refers to using information exchange and policy transfer mechanisms without financial incentives (e.g., ESDP, Territorial Agendas, or the UN 2030 Agenda). Here, we refer to it as triggering mechanisms for initiating actions, projects, plans, programs, or policies. We analyzed the 58 examples of BP, hypothesizing that leveraging BD through spatial planning can be triggered by such mechanisms. To that extent, the criteria were defined as follows:

- "Not applicable" or "No information" (tm=0)
- Stick (tm=1) - Implementing strict regulations and binding commitments that mandate BD conservation within spatial planning frameworks.
- Carrot (tm=2) - Using financial grants or subsidies to incentivize projects integrating BD conservation into spatial planning processes.
- Sermon (tm=3) - Promoting the dissemination of information and encouraging policy transfer that highlights theoretical frameworks and innovative approaches (e.g., concepts, methodologies, and methods) to integrate BD with spatial planning without financial incentives.

C5 - Complexity of implementation (ci)

Each good practice reported as such always translates into a transformation process. This practice can include several aspects that, when combined, can impact into a non-trivial implementation process with different levels of complexity. The following three qualitative levels aim to translate as a descriptor the perceived levels of complexity that must take into account at least the following factors: duration of good practice (1 to 5 years; 5 to 20 years; >20 years); size or area of intervention (up to 10 hectares; 10-100 ha; >100 a); decision-making process involving few actors to many and diverse actors.

- "Not applicable" or "No information" (ci=0)
- Low complexity (ci=1)
- Medium complexity (ci=2)
- High complexity (ci=3)

C6 - Governance mode (gm)

The governance mode adopted by BP can be important to identify and characterize the modus operandi of these situations and can signal the success of BPs.

- "Not applicable" or "No information" (gm=0)
- Government led (gm=1) - a mode of governance led by (public) administration at its different levels, local, sub regional, regional or central.

- Co-governance (gm=2) - a cooperative mode of governance, in which the administration establishes partnerships with different types of non-governmental entities and where bodies with mixed composition are created to lead the processes.
- Non government led approaches (gm=3) – a mode of governance led by civil society or private entities.

C7 – Beneficiaries (bf)

Depending on the object, the problem, the drivers, the trigger or simply the context, just to name a few aspects, it may determine that BP has as direct beneficiaries all people/users or, instead, just some people, as in the case of BD conservation practices that focus on private properties.

- "Not applicable" or "No information" (bf=0)
- All (bf=1) – all types of beneficiaries can benefit from the BP including private and public users;
- Restricted (bf=2) - Only some beneficiaries benefit from BP, for example in the case of companies or private users who own properties subject to interventions related to the recovery of BD.

C8 - Transformative capacity (tc)

The characteristics of Transformative Change, as explained in D1.1, refer to characteristics that define transformative adaptation in social, ecological, and socio-ecological systems.

- Restructuring (tc_1) - changes concern substantial variations of a system's components and interactions.
- Path-shifting (tc_2) - changes entail redirecting current trends and principles governing the system.
- Innovation (tc_3) – changes are driven by new knowledge not implemented before.
- Multiscale (tc_4) - changes involve several spatial, temporal, and governance scales and synergies between sectors

C9 - Ecosystem focus (ef)

This criterion regards the identification of all types of ecosystems that are identified within the reported BP (Odum 1953).

- "Not applicable" or "No information" (ef=0)
- Marine (ef=X or 00) – in principle, the BP dealing with Biodiversity does not refer to marine ecosystems.
- Freshwater (ef=1) – this category of aquatic ecosystems (that includes the marine and freshwater ecosystems) includes the following sub-categories: rivers (& streams), lakes (& ponds), and wetlands.
- River (ef=2)
- Lake (ef=3)

- Wetland (ef=4)
- Terrestrial (ef=5) – this category includes the following sub-categories: Forests; deserts; grasslands; mountains.
- Forest (ef=6)
- Desert (ef=7) – hot & dry deserts, semi-arid, coastal or cold.
- Grassland (ef=8) –temperate grasslands, savannas, steppes or pampas.
- Mountain (ef=9)

C10 – Scale (sc)

The Scale of Intervention is an important element because it can determine different governance solutions or the use of different solutions and methodologies. It is therefore important to distinguish specific, or local interventions, such as the creation of a small garden or the restoration of a small quarry, to more comprehensive interventions to increase BD in a City or in a National Park covering thousands of hectares.

- "Not applicable" or "No information" (sc=0)
- Local (sc=1)
- Municipal (sc=2)
- Intermunicipal or Subregional (sc=3)
- Regional (sc=4)
- National (sc=5)
- European (sc=6)
- Global (sc=7)

C11 – Scope (scp)

The scope refers mainly to the distinction between eminently urban situations (high level of artificialization) and rural situations (in general dealing with forestry and agricultural areas). Although situations on the outskirts of cities can be distinguished, typically in areas designated as peri-urban. If the BPs to promote BD occur in certain areas with a specific land use category, such as: mining areas; brownfields; areas surrounding heavy infrastructures; port areas, etc., all of these situations can be identified as "others".

- Not applicable or "No information" (scp=0)
- Urban (scp=1)
- Peri-urban (scp=2)
- Rural (scp=3)
- Other (scp=4)

Classification of the BP and Lexical Analysis

Classifying BP examples through codification was designed to apply the Alceste method of lexical analysis as outlined by Reinert (1998) in the IRaMuTeQ linguistic software (Ratinaud, 2009). This

approach, already used by the authors of this deliverable (David et al 2024), proved to be useful in exploring arguments and relationships between examples of BP, and their associated criteria, ultimately aiding the discussion on the underlying dimensions that potentially support BP.

Based on R and Python, the IRaMuTeQ supports lexical analysis facilitating a nuanced investigation of word relationships beyond mere frequency counts. The Alceste method, available within IRaMuTeQ, operates under the fundamental assumption that discourse reflects social activity. Therefore, using multivariate statistical analysis of written or spoken vocabulary enables mapping mental environments as lexical worlds (Reinert, 1993, 2008; Marpsat, 2010). These 'worlds' derive from the classes and the factors obtained from descending hierarchical classification (DHC) and factorial analysis.

The process begins by constituting a corpus from the original texts and coding each example of BP as a single variable. This should be done according to a few basic procedures. All texts (examples of BP) should the in a single text file in OpenOffice software (http://www.openoffice.org/), LibreOffice (http://pt-br.libreoffice.org/) software, or in a txt file. The file must be saved in the Unicode format (UTF-8) used by IRaMuTeQ. Each variable will correspond to a text separated by command lines with asterisks. For example, for each example of BP to be recognized by the software as a text, the command lines should be made as follows:

******* *BP1 *pc_1 *fi_1 (...)***

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Sit amet consectetur adipiscing elit ut aliquam purus. Eu consequat ac felis donec et. Venenatis lectus magna fringilla urna porttitor rhoncus.

Where:

i) Variables to be analyzed are represented by four asterisks with no white space before them, one white space after them, an asterisk, and the name of the variable with no white space between them, (i.e., the example BP1).
ii) Criteria to be associated are represented by a space after the main variable, an asterisk, and the code for the variable's criteria, also with no white space between them (i.e., *pc_1; *fi_1), repeating this procedure for all codes.

After preparing the corpus, it was necessary to read it carefully, especially the command lines, since the software does not have a tool for checking and correcting the corpus.

The procedures involved a lemmatization of words by the software (i.e., reducing words to their linguistic roots) and transforming initial context units (ICUs) into elementary context units (ECUs). The software then automatically classifies these units using multivariate statistical procedures (DHC and factor analysis). For the interpretation of classes derived from DHC (i.e., lexical worlds), we followed Smallman's (2016) approach which involved considering at least two interpretations for each class's word lists, testing these against additional data such as typical text segments, chi-squared values, and word frequency by class, and refining or discarding interpretations as needed.

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5. Structuring

This phase aims at systematizing and obtaining results from the information coded and classified in the previous phase. In the first moment, the BP are characterized under the dimensions and sub-dimensions of table 4 from previous chapter, in order to deliver a discussion about the type of BP that contributes in performing BD in the spatial planning. The report finalizes with the conclusions of the task.

5.1 Biodiversity and Spatial Planning according of experts

5.1.1 Contribution of Spatial Planning to halt the loss of Biodiversity

The survey conducted among the participants included a question about the level of confidence they have in spatial planning to prevent the loss of biodiversity. Out of all the respondents, nine participants rated their confidence level with a score of 8 or above in a scale of 10, indicating a high level of trust in the effectiveness of spatial planning. On the other hand, six participants scored 5 or less, suggesting a lower level of confidence in the ability of spatial planning to prevent BD loss.

5.1.2 Causes for Biodiversity Loss

Experts related to BD loss with significant land use changes, such as agricultural expansion over wetlands, pollution, and land fragmentation, but also microscale actions in private areas, high consumption, and wastefulness. Fragmentation caused by urban development and the loss of natural areas and habitats due to infrastructure (e.g., motorways, railways creating barriers to species mobility, or small patch size forest habitats due to urban development fragmentation) were also mentioned. Planning can contribute to reducing this fragmentation through the ecological network idea, particularly at local scales where green infrastructure can link habitats and promote BD. The way projects are implemented has a significant impact. Developing new areas for habitats and planning our cities and infrastructure with ecological concerns can make a substantial difference (e.g., Ian McHarg School). Another issue is related to different ways of spatial planning regulating land use across Europe. This is related to the difficulties of operationalizing a shared vision for a relationship between spatial planning and BD at a supra-national scale due to the EU's lack of competence regarding formal spatial planning.

5.1.3 Bottlenecks that prevent the integration between SP and biodiversity

In interviews conducted, several bottlenecks were identified in implementing BD policies. The discrepancies between planning scales and the relation between global targets and local implementation were flagged by some experts, while others focused on the cross-sectoral integration of sectors such as energy, agriculture, and water. Another significant bottleneck was developers' resistance to balancing profits with BD outcomes and the need for more ecological expertise. The relationship between BD and land consumption for market operators was also found to be a significant concern. National BD-related laws and guidelines, such as the BD Acts, can enhance multilevel integration and effectively implement BD policies. However, planners and decision-makers must also consider the vital role of private development, as the land is predominantly private.

The variation in planning processes across EU countries makes implementing a joint BD Strategy through Spatial Planning challenging. The existing EU binding policy primarily focuses on high-value natural conservation places such as Natura 2000, leaving behind other valuable BD landscapes. Although the Common Agricultural Policy (CAP) is oriented towards maintaining agriculture practices with BD concerns, Pillar 1 is not a strategic tool as it mainly provides resources to farmers so they can keep farming and should be strongly balanced with Pillar 2 (Rural Development), which in turn can be considered a strategic tool for managing BD. Integrating scientific domains across different sectors in the earlier phases of planning processes is crucial. Spatial planners and ecologists should be more involved in planning urban expansion studies, energy infrastructure, solar farms, wind farms, and urban networks. This integration would help to incorporate the concept of green infrastructure right from the start in broader planning scales, avoiding fragmentation of habitats and landscape degradation. Additionally, evaluating the goals established through plans and projects regarding what might happen in the next five or ten years and considering long-term monitoring processes are critical factors in BD management.

5.1.4 Gaps between SP goals and outcomes for biodiversity

Regarding the gaps between spatial planning goals and their outcomes, planners should also monitor the outcomes of BD goals through citizen science projects (e.g., big data) rather than stand-alone initiatives. Those outcomes need to be linked to government-established outcomes from spatial planning policies. There are different interpretations regarding the aims of Spatial Planning. ESPON COMPASS is one recent study that clarifies the aims of spatial planning - for instance, regarding BD, sustainability, and others, across Europe, where there is much diversity. Meanwhile, it is crucial to balance the competing interests of public versus private stakeholders to address the disparities between spatial planning objectives and BD outcomes. Spatial planning inevitably involves conflicts between development and BD, which can clash with green-oriented goals. Conducting an ecosystem services assessment can aid in comprehending the advantages and worth of Nature.

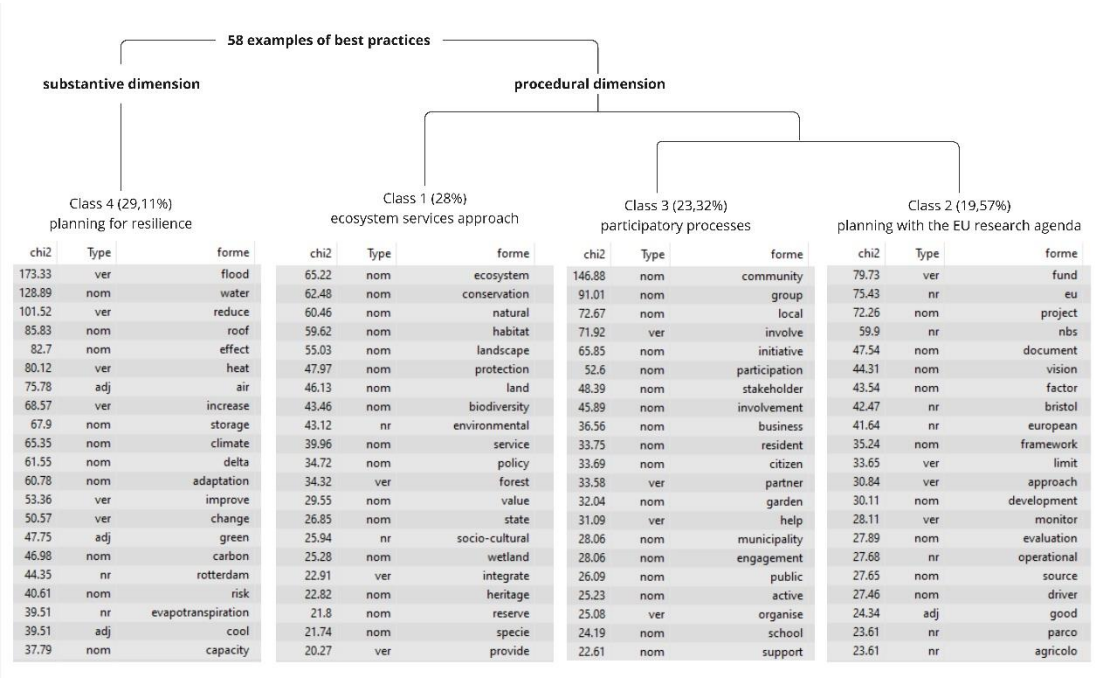
5.1.5 Lexical worlds

Table 5 summarizes the variables decomposed. The description of the 58 examples of BPs were divided into 1356 text segments containing 5389 forms (words), 4213 of which were lemmatized. Within the corpus, 1175 text segments were classified (86,65%) originating in four classes (Figure 4)

Table 5: DHC Summary

Descending hierarchical classification (DHC)	
texts	58
text segments	1356
forms	5389
occurrences	48850
Lemma	4213
active forms	3715
classes	4
# of segments classified	1175
% of segments classified	86,65%

The following figure shows the lexical worlds. Due to limited space, only the top 20 significant words for each DHC class are displayed as $\chi 2$ values in Figure 4.



chi2	Type	forme
173.33	ver	flood
128.89	nom	water
101.52	ver	reduce
85.83	nom	roof
82.7	nom	effect
80.12	ver	heat
75.78	adj	air
68.57	ver	increase
67.9	nom	storage
65.35	nom	climate
61.55	nom	delta
60.78	nom	adaptation
53.36	ver	improve
50.57	ver	change
47.75	adj	green
46.98	nom	carbon
44.35	nr	rotterdam
40.61	nom	risk
39.51	nr	evapotranspiration
39.51	adj	cool
37.79	nom	capacity

chi2	Type	forme
65.22	nom	ecosystem
62.48	nom	conservation
60.46	nom	natural
59.62	nom	habitat
55.03	nom	landscape
47.97	nom	protection
46.13	nom	land
43.46	nom	biodiversity
43.12	nr	environmental
39.96	nom	service
34.72	nom	policy
34.32	ver	forest
29.55	nom	value
26.85	nom	state
25.94	nr	socio-cultural
25.28	nom	wetland
22.91	ver	integrate
22.82	nom	heritage
21.8	nom	reserve
21.74	nom	specie
20.27	ver	provide

chi2	Type	forme
146.88	nom	community
91.01	nom	group
72.67	nom	local
71.92	ver	involve
65.85	nom	initiative
52.6	nom	participation
48.39	nom	stakeholder
45.89	nom	involvement
36.56	nom	business
33.75	nom	resident
33.69	nom	citizen
33.58	ver	partner
32.04	nom	garden
31.09	ver	help
28.06	nom	municipality
28.06	nom	engagement
26.09	nom	public
25.23	nom	active
25.08	ver	organise
24.19	nom	school
22.61	nom	support

chi2	Type	forme
79.73	ver	fund
75.43	nr	eu
72.26	nom	project
59.9	nr	nbs
47.54	nom	document
44.31	nom	vision
43.54	nom	factor
42.47	nr	bristol
41.64	nr	european
35.24	nom	framework
33.65	ver	limit
30.84	ver	approach
30.11	nom	development
28.11	ver	monitor
27.89	nom	evaluation
27.68	nr	operational
27.65	nom	source
27.46	nom	driver
24.34	adj	good
23.61	nr	parco
23.61	nr	agricolo

Figure 4: DHC results

Class 1 – The ecosystem services approach

Class 1 identifies statistically significant words such as 'ecosystem,' 'conservation,' 'natural,' 'habitat,' 'landscape,' 'protection,' 'biodiversity,' or 'service,' indicating a thematic focus on the ecosystem services approach within the realm of spatial planning processes. Results suggest that exemplary practices of this class are related to attempts to integrate the ecosystem services

framework into spatial planning. For instance, BP19 (Landscape and Recreation Value Trade, in Finland) or BP20 (Cultural seascapes: Social-cultural valuation of ecosystem services in Fingal, County Dublin, Ireland) (Figure 5). In the first case, the goal was to introduce a Payment for Ecosystem Services (PES) system where forest owners are compensated for improving landscape and recreational values in their forests. The example shows an innovative planning mechanism: selecting valuable forest areas for biodiversity, landscape, and carbon stock and running a pilot project to fund and implement forest management changes that enhance ecosystem services. The second example analyzes socio-cultural values in a coastal setting, focusing on how ecosystem service approaches contribute to land use or spatial planning. In this case, the example builds on people attaching socio-cultural values to the natural environment. These values strongly influence cultural ecosystem services, providing tangible and intangible benefits when people interact with nature and providing a basis for internalizing it into spatial planning.

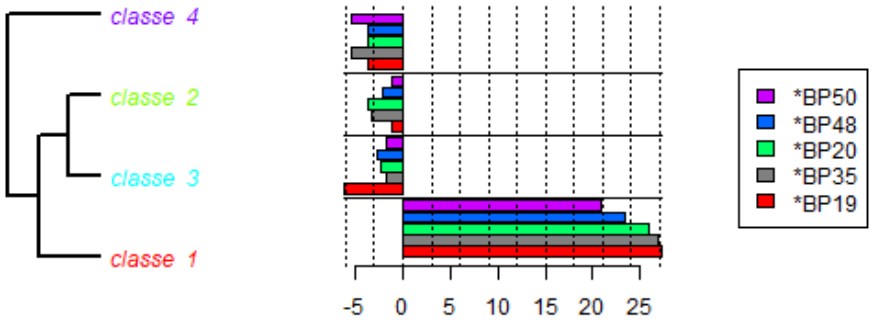


Figure 5: Statistically significant (chi-squared) examples of BP in class 1

Regarding the criteria, the results suggest that the focus on ecosystem services is quite broad (e.g., ef_12345678 9). The triggering mechanisms are based on stick policies, benefiting the public and private sectors. The transformative capacity is more related to strategy building and information baseline (Figure 6).

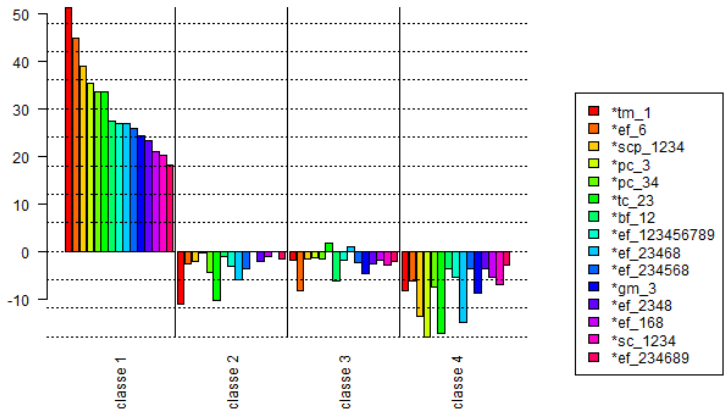


Figure 6: Statistically significant (chi-squared) criteria in class 1

Class 2 – Planning with the EU research agenda

Class 2 identifies statistically significant words such as 'fund,' 'EU,' 'project,' 'NBS,' 'document,' 'vision,' 'European,' or 'framework,' indicating a thematic focus on the importance of using the EU research agenda within the realm of spatial planning processes. The results suggest that the exemplary practices in this class are related to projects that reflect a set of values and methodologies related to the European political agenda. For example, BP6 (Transition Planning - Parco Agricolo) and BP11 (Szeged - NbS for urban regeneration and climate change adaptation) (Figure 7). The first example, BP6 concerns the construction of a strategic vision for an agricultural park on the outskirts of Rome, where there is a strong relationship with the EU's research agenda, as the municipality's team was supported by BIC Lazio and OSMOS Transversal Planning, a spin-off of TURAS, which was an EU-funded project 'Transitioning towards Urban Resilience and Sustainability'. The second example BP11 refers to an NBS project for the Hungarian city of Szeged, where there is a history of European funding related to green infrastructure, namely through operational programs (2004-2006, 2007-2013, 2014-2020). The currently planned territorial operational program contains priority axes for green infrastructure development.

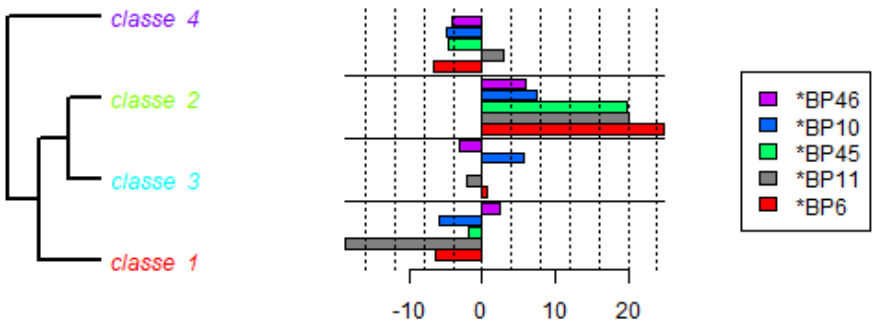


Figure 7: Statistically significant (chi-squared) examples of BP in class 2

Regarding the criteria, the results suggest that the emphasis on ecosystem services is also quite broad (e.g., ef_12568), which aligns with the nature and scope of the NBS projects. The triggering mechanisms are based on a varied portfolio of 'stick' and 'sermon' policies, possibly resulting from a certain degree of Europeanization due to integration processes, but also with a strong component of 'carrot' mechanisms, as the available European funds are strong incentives for the development of these types of actions (Figure 8).

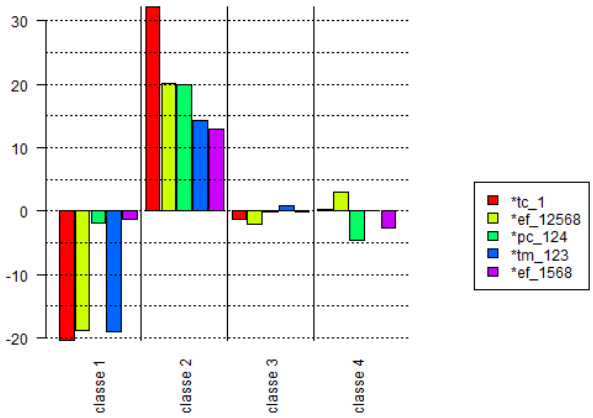


Figure 8: Statistically significant (chi-squared) criteria in class 2

Class 3 – Participatory processes

Class 3 highlights statistically significant words such as 'community,' 'group,' 'local,' 'involve,' 'initiative,' 'participation,' 'stakeholder,' and 'citizen,' indicating a thematic emphasis on the importance of participatory processes and the quality of governance within spatial planning. For instance, B16 (Community Interest Company Barking Riverside) and BP33 (The Toolkit for Ecosystem Service Site-based Assessment – TESSA) illustrate this focus. The first example aims to build social capacity within the Barking Riverside community, a residential area in London, through a Community Interest Company (CIC). It actively engages residents in designing, managing, and maintaining local green and social assets. The second example provides a user-friendly method for assessing ecosystem services, employing household surveys, participatory mapping, and habitat surveys within a simple modeling software. Both examples support a qualitatively distinctive approach to participation, involvement, and governance in spatial planning.

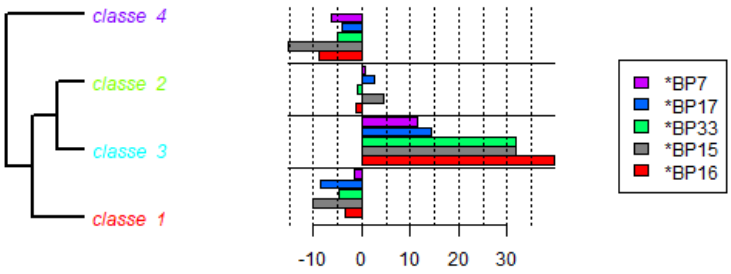


Figure 9: Statistically significant examples of BP in class 3

Regarding the criteria, the results suggest that the emphasis on ecosystem services is still quite broad (e.g., ef_2568), which can reflect the participatory mapping of ecosystem services as a growing practice within planning processes. The governance mode is most related to co-governance arrangements or non-government-led approaches (gm_23). The transformative

capacity reflects innovation and restructuring (tc_13), indicating that changes are driven by new knowledge not implemented before or that substantial variations of the system's components and interactions are taking place, mainly benefiting public users (bf_1).

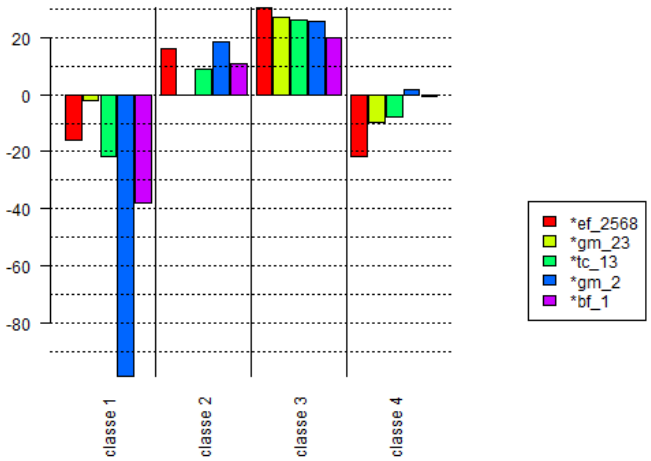


Figure 10: Statistically significant (chi-squared) criteria in class 3

Class 4 – Planning for Resilience

Class 4 highlights statistically significant words such as 'flood,' 'water,' reduce,' roof,' 'effect,' 'heat,' 'air,' and 'increase,' indicating a thematic emphasis on the planning for resilience. The findings indicate that exemplary practices in this category are linked to projects or strategies addressing the impacts of climate change on urban areas and their inhabitants, regardless of scale. For example, B1 (Rotterdam - Nature-Based Solutions for creating a waterproof city) and BP3 (Green Roof and Water Management in the Philippines Government Office Building) exemplify this emphasis. The first case aims to achieve Rotterdam's goal of becoming 100% climate-proof by 2025, as outlined in the city's climate adaptation program, which this Nature-Based Solutions project supports. The second instance involves enhancing building energy efficiency and adaptability to changing environmental conditions. This was achieved by incorporating multiple green spaces, two 'pocket gardens' at intermediate levels, and a green roof (Bio Roof) in government buildings.

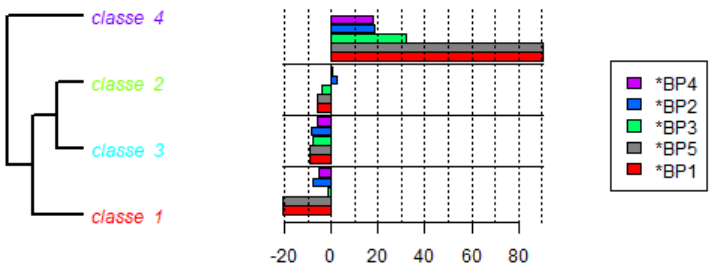


Figure 11: Statistically significant examples of BP in class 4

In terms of criteria, the findings indicate a wide-ranging emphasis on ecosystem services (e.g., ef_1245), primarily at a local or municipal scale (sc_2 and scp_1). The triggering mechanisms are largely incentivized by positive incentives and communication efforts ('carrots and sermons'). The transformative capacity reflects innovation and restructuring (tc_13), suggesting that changes are propelled by novel knowledge or significant alterations to system components and interactions (see Figure 12)."

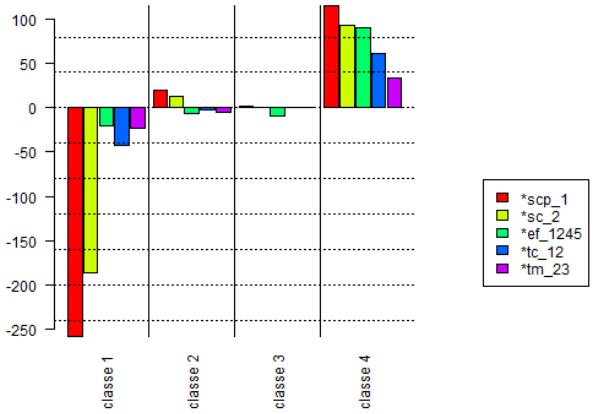


Figure 12: Statistically significant (chi-squared) criteria in class 4

5.1.6 Underlying dimensions

The Alceste method identified cohesive classes or groups of textual segments based on shared lexical patterns and co-occurrences of words exhibiting similar linguistic features or thematic content (lexical worlds). Following the formation of classes, the software conducts a factorial analysis, often using principal component analysis (PCA) or multiple correspondence analysis (MCA), to project these classes and their constituent words onto factorial planes. These planes are constructed to maximize the variance explained in the dataset, providing a visual and statistical framework for interpreting the relationships between classes and the most frequent words within them. By elucidating these relationships, reflecting on underlying structures that may not be fully apparent in the initial dataset becomes feasible. In this instance, factorial analysis enabled a nuanced exploration of two fundamental dimensions that underpin the observed patterns within this sample of BPs. These dimensions provide a framework to discern and understand the intricate relationships and variations among the analyzed textual elements, shedding light on the examples' substantive and procedural dimensions (Figure 13). In this context, classes 1 and 2 are clearly associated with a procedural dimension, and class 4 is associated with a substantive dimension, explaining 75% of the total variance together. Class 3 serves as a hinge between the two dimensions, facilitating their connection and interaction.

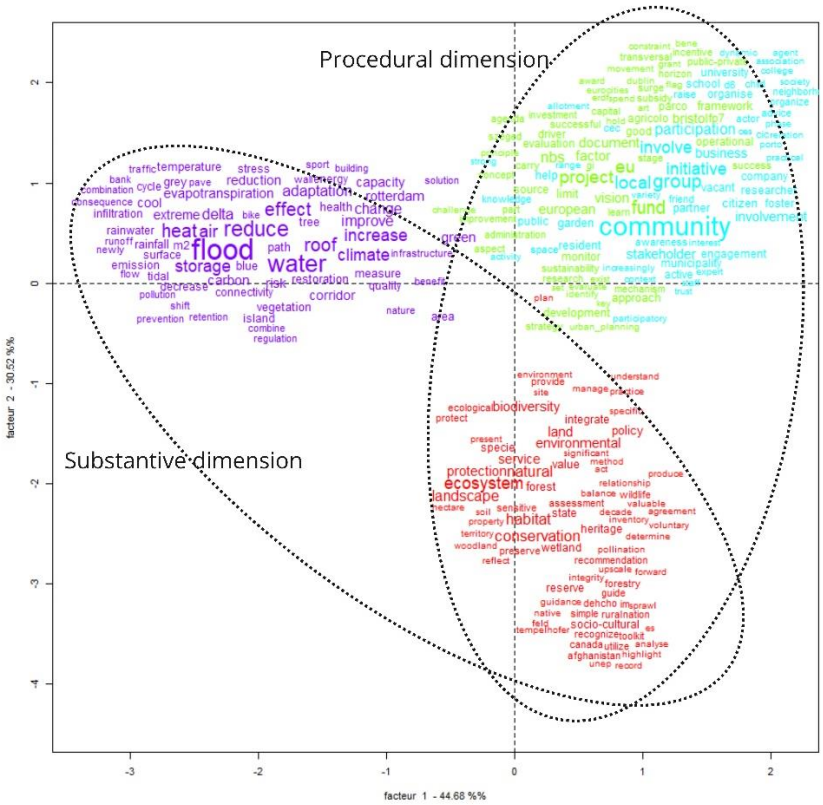


Figure 13: Factorial analysis and the underlying dimensions supporting the BPs sample

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6. Discussion

The lexical analysis of the BP sample yielded four distinct DHC classes, each representing different lexical worlds (see Chapter 5). Additionally, a factorial analysis revealed two main factors, explaining 75% of the total variance in the dataset (Figure 13). These factors form two primary underlying dimensions - one procedural and one substantive, having in common a third subdimension related to the ecosystem services approach.

Because such dimensions were derived predominantly from the BP suggest that our inductive approach can serve as a confirmatory analysis of previous assumptions mentioned in Chapter 1 regarding analytical criteria definition. Moreover, results also suggest that these two core dimensions share the same subdimension which is related to the ecosystem services approach. This indicating that such an approach can serve as a leverage to integrating biodiversity into spatial planning.

Because the results of the lexical analysis also align with our predefined classification criteria discussed in Chapters 1 and 4, the next section will discuss the results against the backdrop of these two dimensions and the corresponding list of criteria. If needed new aspects found will be added here.

6.1 Procedural Dimensions

6.1.1 Planning Components

Vision & Strategy

Examples of explicit integration of BD conservation into the Vision [BP1,5,6,12.18,21,29,38,42,45, 49] are in general followed by different types of related BD policies and lead to high-level Plans namely Biodiversity Action Plans. It is expected that the success of the integration of BD into the Vision will depend greatly on the level of discussion and involvement of the population in this process, the type of participation process, and the leadership of those who coordinate the planning process.

In some BP examples there are references to the adoption of a specific related BD strategy but without elements confirming that the strategy(ies) was preceded by the establishment of a broad vision that integrated BD into the aspirations of the territory/city in question [BP8,10,11,15,16,17,19, 23, 39, 40, 44, 48, 50,51,54,55,57].

There are also BP examples where the opposite occurred. That is, the existence of references to the construction of a vision integrating BD but without explicit reference to which strategi es were used to achieve it [BP4, 7, 37].

Information Baseline

Many BP examples express the acquisition of new information or data and how that was important for the success of the subsequent planning process related to BD protection [BP2,5,6,9,20,33,36,48-55,57-58].

The planning process benefits from reliable and updated data and information to allow consistent planning options to be taken and to make effective decisions. In some BPs, it was necessary to launch specific studies to acquire specific information on ecological values present or to be protected and to more rigorously assess the loss of BD.

In some BP, the public availability of data and their subsequent awareness raising by the community, including the academic and research community, made it possible to capture the attention of media and some stakeholders and, subsequently, the launch of planning instruments with greater effectiveness and greater political support for the protection of BD values. This will be illustrated in the following paragraphs.

In Montréal (BP53) three main studies - Sensitive Ecosystem Inventory (SEI), Sensitive Habitat Inventory and Mapping (SHIM), Wetland Inventory, Classification, Evaluation, and Mapping (WIM) – funded by several public and private organizations including a Real Estate Foundation, generate new knowledge that was fundamental to support sustainable land use and development decisions that help promote effective stewardship. The inventory study suggests that urban development is the primary factor leading to the degradation of ecological functions within the area. Planning practices, both long-term and current, benefit from inventory and GIS mapping, as they provide a baseline of quantitative data to measure the impacts of future actions. The studies generated media attention because of the scale (city-wide) and detail. These initiatives were valuable for local governments and land use decision-makers. These successes spread the word and have led to other municipalities conducting their studies. This new knowledge helped to build internal capacity at local administration concerning the natural environment.

In Guelph (BP51 - the mining City of Greater Sudbury over two centuries) the "Sudbury Soils Study" and the subsequent "Ecological Risk Assessment" is the trigger to start a huge process of regreening 84.000 ha of barren or semi-barren land.

In Toronto (BP55) the *Biodiversity Series* - a collection of publications on the variety of species found within the city - has cultivated a sense of environmental stewardship in residents by providing learning opportunities on biodiversity. It highlights the interconnected relationships among each species while emphasizing an appreciation for the current state of biodiversity within the city. This Series was developed by several working groups (City staff, local experts, and academics) that have been strong advocates for the City of Toronto to endorse a biodiversity strategy; another study - *Bird-Friendly Development Guidelines* – was related to urban areas posing a great threat to bird populations as birds often collide into large buildings causing hundreds of injuries and fatalities daily. To address this, the City of Toronto instituted a public awareness campaign, Lights Out Toronto! (LOT!) in 2006, to encourage buildings to switch off office lights. This study released in 2007, started as a voluntary initiative (including local architects, developers, building managers, academics, bird advocacy groups, and City staff) to make new and existing buildings less dangerous for migratory birds.

Information baseline regarding BD new knowledge is also crucial for monitoring BD policies and related objectives because it establishes initial reference points for strategy establishment, actions, and ongoing evaluation. For instance, in BP 19 and BP20, a deeper ecosystem services knowledge allowed for considering innovative planning mechanisms (BP19) aiming to internalize intangible benefits perceived by people into spatial planning processes. Moreover, In BP48 the new Biodiversity Strategy allows updating its inventory of natural areas, species at risk, sensitive ecosystems, and monitoring known species habitats. The responsibility for collecting data and monitoring will fall on various departments of local governments, external parties, and stakeholders that work closely on BD protection issues. This way of operationalizing monitoring, also called distributed monitoring, reduces administration effort and costs, although there may be a risk of loss of confidence in the data.

Actions, Planning instruments, Regulations

Considering the list of BP examples, 31 out of 55 BP are related to some actions that directly contribute to the promotion of BD or include other types of planning instruments or regulations that constrain private actions to avoid BD loss.

The analysis of BP examples reveals many initiatives that can be framed as a "project" - meaning a type of planning instrument that can be developed following the preparation of plans and that usually anticipates the actual implementation of an action (for example, a green space or a horticultural garden). As expected, most of these BP examples, concerning the implementation of Nature-Based Solutions (NBS), are based on local projects.

Not all projects that may be implemented over time are foreseen in the plans. They can emerge from new initiatives or new ideas, coming from the administration or civil society. It is desirable that they are at least framed by planning, that is, aligned with planning strategies and BD objectives.

In Guelph (BP51) a component of the Guelph City's Official Plan acknowledges the importance of pollinator species and their habitat. However, the project for a new "Pollination Park" was initially proposed by community members advocating for the City Council to realize the importance of pollinator species, and the lack of pollinator habitats within urban areas. The engaged community members got together and formed "Pollination Guelph", which was later designated by the City Council to act as the official working group to spearhead The Pollination Park. A Technical Committee, represented by City staff and Pollination Guelph members, reviewed all legal matters related to the creation of the pollinator habitats in Guelph and acted as the liaison between the City and other stakeholders. Pollination Park may represent a progressive biodiversity initiative or project that was driven by the community.

In many examples of BP, we can find different types of plans and studies: Open Space Plan, Biodiversity Strategy, Biodiversity Plan in BP48; Park Management Plan in BP49; Ecological Design Report; Wildlife Passages Engineering Design Guidelines; Biodiversity Action Plan; Natural Area Management Plan; Urban Forest Management Plan in BP48; The Master Plan and Strategic Plan for Sustainable Development in BP55 or Urban Development and Natural Environment Master Plan in BP56.

There are no recipes to be found here because these types of plans are often designed to suit a set of needs and are almost always context-dependent. It appears that in general all these plans and studies contribute to the definition of the land use plans that regulate and guide the actions of private entities and, in particular, land owners and developers.

Another example is the Biodiversity Net Gain (BNG), a nationwide development approach and a mandatory instrument in England since 2024, that decrees a 10% net gain in biodiversity, ensuring habitats are left in a better state post-development. BNG is measured in standardized units based on habitat size, quality, location, and type, using a statutory biodiversity metric tool. Developers must first attempt to achieve BNG on-site; if this is insufficient, they can use off-site units or, as a last resort, purchase statutory biodiversity credits from the government. Habitats created or enhanced for BNG must be maintained for at least 30 years. Developers submit a biodiversity gain plan for approval by the local planning authority, detailing how they will meet BNG requirements, and may face enforcement action if they fail to comply.

Territorial models

Planning tools are also related to spatial or territorial models, regarding the best structure to be formalized in a plan and to be achieved for the vision of a city or a territory. Sometimes the design of sectoral structures may appear translated to a network as is the case of road/railway networks, networks of social facilities, or, as in this list of BP examples, Ecological Network Model [BP50], Green Infrastructures networks [BP8,9,24,25] or Green Belts [BP32,43].

Urban management and land policy

Regarding other planning tools, it is noticeable the idea of making *Green Roofs* (or/and *green walls*) on the top of buildings. Local governments use green roofs as an extension of biodiversity initiatives as they are an effective way to address some of the major challenges facing the urban environment, such as habitat loss, air quality, and the urban heat island effect. It is an alternative way to integrate an ecosystem into the urban landscape and increase green space. In BP3 and BP55 we may find examples regarding Green Roof Policy, a Green Roof Bylaw, a Green Roof Strategy and Green Roof Demonstration Projects.

Land Compensation Mechanisms play a crucial role in various contexts, ensuring fair treatment when land is acquired or lost. Governments sometimes need to acquire land for different purposes and compulsory acquisition grants them this power. Compensation is essential to protect landowners' rights and maintain public trust. The use of land compensation mechanisms is referred to at least in BP48 concerning the Wetland Conservation Plan. This Plan has strong policies regarding the protection of wetland habitats as well as a component that focuses on land compensation mechanisms. The City can collect compensation funds from developers and use those funds at a later date for future wetland preservation.

Land acquisitions by local governments can significantly catalyze strategy implementation. For instance, in the case of BP13 (Park Spoor Noord in Antwerp), the City of Antwerp purchased a 24-hectare area, 1.6 kilometers long, that was previously a railway yard owned by the Belgian national railway company. This area had a negative reputation due to issues related to drugs and prostitution. Following the acquisition, the city initiated a participatory planning and governance process to transform it into a vital piece of urban green infrastructure. Another example is the BP50

(City of Edmonton, Alberta), in which, it is mentioned that habitat fragmentation is a major contributor to BD loss. The city has incorporated urban design in a biologically sensitive approach to city planning. Land acquisition became a key area of interest to the city. The Edmonton and Area Land Trust is a resource established to create partnerships with private landowners and allocate funds to purchase valuable lands. The Land Trust is the result of collaboration among environmentalists, philanthropists, developers, and the city.

In BP57 (City of Winnipeg, Manitoba, Canada) a 100-acre urban forest was characterized as a forest that remains 'virtually undisturbed'. Urban development was a large threat to the state of the forest, but the "City and residents worked to protect this space by moving land ownership away from developers and into the hands of the city. It is now a municipally-owned forest that will remain preserved and protected for future generations".

6.1.2 Protection status for BD

The option to apply a *protection statute* has been a commonly adopted solution in spatial planning. Sometimes this happens following the elaboration of specific sectoral plans which leads to the classification and regulation of the area, conditioning management practices and uses that can threaten environmental/ecological values. Protection can also occur by acting on the individual protection of species (flora and fauna). The protection status can be very operational in the urban planning process.

The classification and regulation of land use, through municipal plans or urban land use plans, often have difficulty controlling activities that threaten BD other than operations involving the construction of infrastructures or buildings. In general, land use plans, in their successive revisions over time, tend to base their options considering the base reference given by the old zoning and therefore, require a high level of justification to change, for example, the classification of use of certain natural areas for another type of use. On the other hand, they are subject to changing vision and strategy depending on the challenges that arise, which are many, for example in cities facing pressures for densification, which means that land use classification at the local level may not be as definitive as it may seem.

Therefore, different BD protection statutes can be granted at different levels: central level such as [BP49] (Dehcho First Nations, Canadá) or [BP39] (Biodiversity Net Gain, in England), regional level such as [BP55] (City of Toronto, Ontario, Canada) or [BP29] (Duero Valley Regional Plan in Spain) and municipal level such as [BP41] (Friends of Portbury Wharf, Portishead, England). All these have different degrees of control.

In Montreal [BP53] the focus of municipal operations was on the protection of natural areas through a Policy to Protect and Enhance Natural Habitats, conservation projects, a Municipal Tree Policy and tree inventories, arboreal plans, strict rules to protect tree health, etc.

The town of Wolfville [BP58] and a local higher education institution are working towards implementing the model "Town as an arboretum" to protect the forest system (one of the rarest regions of the biome, identified by the co-existence of many different tree species live an average of 150 years, with undisturbed old growth trees living 400 or more years). Although this BP is closely linked to a very specific local context, it seems to be a good example in which protection (which eventually continues to be established by rules and laws) was extended to the cultural field,

common values and local identity, tying the population to the control and to the protective system itself.

In Edmonton [BP49] the city was able "to protect five hectares for every eleven hectares of Priority Natural Areas". The City of Trois-Rivières (BP55), to maintain an equal balance between urban development and land conservation, adopted the slogan "one protected hectare for each developed hectare". The protective status can also be used as a motto to communicate a committed BD conservation strategy.

6.1.3 Triggering mechanisms

The mechanisms that trigger BP can vary widely, influenced by factors such as the scale at which the BP was developed and the planning system's tradition to where it belongs. A more coercive approach (stick) is evident in planning processes at the regional level, while a more regulatory approach is seen at the national level. Examples include regional or metropolitan planning instruments related to green infrastructure development, such as BP27, 28, 29, 32, 36, 39, 40, 42, and 43. Notable instances from Spain include the Supraregional Planning Guidelines for Segovia and Surroundings, the Valle Del Duero Regional Plan, the Green Belt in Victoria Gasteiz, and the Green Crown project. At the national scale, regulatory instruments like BP36 (Environmental Rural Registry (CAR) in Brazil) and BP39 (Biodiversity Net Gain in England) function as top-down policies aiming to influence all subsequent planning tools at regional and local levels.

While there are no examples triggered solely by financial compensation mechanisms (carrots), such mechanisms are associated with sticks and sermons in many cases, particularly in projects related to Nature-Based Solutions (NBS), because often these are co-funded by European funds (e.g., BP4, BP8, BP11, BP12, BP13, BP15, BP18). Other examples include urban green infrastructure projects such as the green corridors in Lisbon (BP25), Park Spoor Noord in Antwerp (BP13), and the Luas Cross City - Landscape Strategy (BP47). In all these examples, there is an association with policy transfer mechanisms (sermon), as these local actions tend to reflect global values and agendas, such as EU cohesion policies, or sustainable development-related policies.

6.1.4 Complexity of Implementation

As mentioned before BP can be more or less complex influencing its transferability to other contexts. Systemic complexity is usually related to the quantity of elements and relationships present in the system. For the characterization of BP, it was considered the duration of the good practice (i.e., the persistence), the size of the intervention area, and the amount and diversity of actors involved in the decision-making process. In this list of 58 BP, it was found the following quantity according to each level of complexity:

Low complexity # 13; // Medium complexity #12 // High complexity # 30

Based on this BP sample, we can take the risk of considering that BP examples that relate spatial planning with biodiversity are not yet trivial and the complexity level of these types of BP tends to be higher than low.

6.1.5 Governance Mode

The distribution of BP across each of the three different approaches initially envisaged (not considering combinations) shows that they are led-government practices. But it is notable the appearance of numerous BP involving the co-governance mode.

Government led #21// Co-governance #15 // Non-government led approaches #5

BP49 is an interesting example as it refers to a self-governing native community (Dehcho First Nations) located in the southwest corner of the Northwest Territories of Canada. The region is home to some of the Country's most diverse and protected landscapes, most notably, the Nahanni National Park Reserve, a legendary icon of Canadian wilderness. The Dehcho First Nations and the Government of Canada have been cooperatively managing the park by incorporating traditional knowledge and connectivity to maintain the natural heritage of the geographic region. Parks Canada has been working through the Dehcho Process, a land-use and self-governance process to maintain the area's ecological integrity and establish long-term management planning, through a Consensus Team comprised of four appointees from the Dehcho First Nations, and three appointees designated by Parks Canada. It's a cooperative management and one example of a local community that plays an active role in the protection of a park that is also their home.

The co-governance mode seems to facilitate the emergence of innovation and transformation capacity as mentioned by IPBES (Tengö et al., 2017). However, it is necessary to pay attention to what may emerge from the transformation processes after some time. For instance, the acceleration of the gentrification processes may happen in cases like BP The old railway track circuit in New York BP22, (Argüelles et al., 2022), raising complex social issues related to original residents often facing rising rents and a higher cost of living.

Non-government-led approaches can be found in BP19,22,26,41,45. There are many known bottom-up initiatives not involving local government. Sometimes it is an appropriate response to solve many common problems where the administration doesn't have the capacity to provide satisfactory responses. Other times it can pose a problem, especially when individuals start doing things without specific knowledge to do them well. For instance, BP26 (Tamera), as it is described, can either represent a good or bad thing for BD, depending on how the landscape is managed.

In these non-government-led approaches, and regarding BD and NBS, it seems advisable that the planning process give space for controlled experimentation, over some time, under the purview of a contracted agreement that can be monitored.

6.1.6 Beneficiaries

In general, when the local government leads the process, BP's beneficiaries are all stakeholders and the entire population. Just BP3, BP19, BP26, and BP34 regard situations where some private users or owners are the only beneficiaries.

6.1.7 Transformative Capacity

Restructuring

Transformative capacity may be developed through organizational changes introduced in the structure of the administration that controls the spatial planning and management process. This issue is not new and happens frequently when new executives are elected for a new term. Usually, it is common for local governments to find an organizational structure that separates planning services, more linked to the preparation and implementation of plans, urban management services more linked to construction permits, and environmental services that traditionally are more related to the project and management of green spaces. These services are generally integrated into a hierarchical (vertical) organization, from Departments to Divisions and smaller working units that are simpler and more focused on a certain type of concern. The vertical integration of knowledge (and competencies) is horizontally integrated through different ways - integrated projects with the participation of different services, ad hoc groups established for a specific purpose, coordination bodies, etc.

Collaborative/cooperative approaches can be analyzed internally, regarding a local governmental organization and also can be analyzed externally, when stakeholders and the community are called upon to interact with local administration. In BP55 the success of the planning tools is attributed to the collaborative work between various municipal departments - the City's Urban Planning Services and Sustainable Development Division - through complementary perspectives and actions that benefited ecosystems and biodiversity conservation. Their joint experiences helped determine which tools could achieve the best results. Cross-departmental initiatives are a key way to building internal capacity as collaborative approaches to solving large-scale problems allow for greater learning, increased access to resources, and complementary policies among multiple departments.

Path-shifting

Some BPs are anchored on a true change in the economic development model that leverages other changes in the vision of the city/territory, to start incorporating nature and the preservation of ecosystems, and which also implies changes in the instruments to implement this new development strategy. Participation, engagement, and coworking, in their different nuances concerning the planning process and stakeholders can be success factors, normally associating path-shifting with innovative capacities. For instance, the Land Trust in BP2 (London - NbS for a leading sustainable city) has developed a service charge financial model for developers to ensure the maintenance of the green infrastructure in the long term, or the payment for ecosystem services system in BP19 (Landscape and Recreation Value Trade, Finland) in which forest owners are compensated for voluntarily enhancing the provision of landscape and recreational values in their forests through an innovative mechanism consisting of internalizing intangible benefits into the planning process.

In the BP55 the City has high industrial activity and has a large port. The economy of the city has shifted from predominantly pulp and paper production to smaller industrial activities such as aeronautics, light-metal production, and furniture production. The city adopted the following policies to serve as planning and guidance tools: a Sustainable Development Policy, a Landscape and Forest Heritage Conservation Policy, and the *Urban Development and Natural Environment Master Plan* which reinforces, in its name, the political importance of changing strategy for the city of 130.000 inhabitants.

Innovation

Some BPs already mentioned before are good examples to illustrate this 'Innovation' topic, that is, when changes are driven by new knowledge not implemented before. BP3,9,14,16,33,34,35 was explicitly coded as having been 'innovative'. However, given the available information for each BP, it must be noted that it is often difficult to discern what should be considered 'Innovation' which should be different from 'Path-shifting' or even 'Restructuring'. Therefore, in 15 BP, 'Innovation' appears combined with those two transformation factors. It would like to say that these 3 transformation factors (Restructuring, path-shifting, and innovation) tend to appear combined, and in particular the 'Innovation' factor which, as it represents a novelty, may naturally require changes in governance structures and may represent a substantial change in the course of events and/or policies. Green infrastructures, green roofs, ecosystem services, and NBS corridors are natural novelties.

As an example, the 'High Line' project (BP22 - The old railway track circuit in New York) can be mentioned as being highly innovative in that it concerns the conversion of a completely artificialized railway viaduct, that was deactivated to make way for a linear green structure through a co-governance process, not led by government, purely local scale and urban scope. The Innovation is related to the novelty of the object and its reconversion process into something that one might think was impossible to achieve but can also be related to the way the process is managed (e.g., the financing process) along with the use of new knowledge (e.g., the payment for intangible ecosystem services such as in the BP 19 Landscape and Recreation Value Trade, Finland).

Multiscale

Multiscale regards changes implying several spatial, temporal, and governance scales and synergies between sectors. BP23,27-32, 37, 38,42,44,46,47,51 are examples of reporting multiscale changes.

For example, the City of Greater Sudbury (BP51) has undergone many changes moving away from a reputation of being an environmentally damaged, mining community. Diversifying the economy was a huge complex process implying *restructuring* and *path shifting* and has given the city economic strengths. At present, the city has focused on maintaining its new reputation as an environmental leader, through extensive regreening programs to restore fragile and damaged landscapes. Through extensive regreening efforts, Greater Sudbury is an example of what is possible by reintroducing nature to the city. Build, sustain, and nurture partnerships at all levels: between the municipality and school boards, universities, industries, researchers, government agencies, and local naturalists.

6.2 Substantive Dimensions

6.2.1 Ecosystem focus

In many situations [BP54] the trigger for the adoption of BD strategies is addressed by the impact of (urban) development and the broad recognition of the need to adopt land and ecosystem

conservation strategies. Some problems affecting different types of ecosystems leveraged several initiatives and concrete planning actions to promote BD.

Freshwater (rivers & streams, lakes & ponds, wetlands, estuaries)

Pollution of freshwater quality, water scarcity, and other problems related to rainwater drainage are commonly related to human activities (urban areas, industrial areas, etc.). City's water management initiatives concerning water and Wetlands [BP1, 3, 29, 37, 47,48, 53, 54, 55, 56] or in Urban Open Spaces can lead to the recognition that BD is the framework that ties several previous efforts [BP47,48, 53, 54, 55, 56]. That was the case in several BP activating the adoption of different planning instruments to manage water-related ecosystems: Wetland conservation plan, Open space plan, Biodiversity strategy, Biodiversity plan [BP47], Ecological Integrity Statement, Park management plan [BP48], Policy to Protect and Enhance Natural Habitats and The Greening Strategy - to reduce the urban heat island effect and maintains infrastructure for sound management of overland runoff [BP53];

Terrestrial (forest, desert, grassland, mountain)

Terrestrial ecosystems face significant challenges due to drivers such as land use changes. Land use policies can either preserve or lead to habitat destruction, fragmentation, and biodiversity loss. Urban expansion, agriculture, and infrastructure development are key contributors, disrupting natural processes and reducing ecosystem resilience. Terrestrial 'ecosystems focus' is present in 31 of the 58 samples of BP, reflecting the commitment of such examples in maintaining or improving their ecological functions and services. These are the cases of NBS projects or programs related to green infrastructure [BP1, 4, 5, 6, 7, 8, 10, 11, 13, 15, 16, 17, 18, 21, 22, 24, 25, 26, P27, 28].

6.2.2 Scale

Concerning the scale of the practices reported, 43 out of 55 are local, municipal, or inter-municipal. Just a few cases are regional scale. Eight cases mention the inter-municipal level which is relevant given the known difficulty of operationalizing common policies or implementing solutions on this scale that imply understanding and sharing of resources between contiguous administrative units (municipalities).

6.2.3 Scope

The 45 out of 55 urban or periurban BP are dominant in the list of BP examples. However, there are 6 regarding purely rural land uses (forestry or agriculture or natural spaces) and 18 may be related to urban or periurban forest or agriculture situations in urban or periurban areas. Many of these situations are related to urban development pressures.

7. Conclusion

The best practices scrutinized show that despite the immense spectrum of situations, patterns emerge from the analytical process that are promising for contributing to transformative change. The interplay between the "substantive" and the "procedural" dimensions seems to play a key role in leveraging biodiversity in the planning process. Notably, the investment in the collection and dissemination of information on biodiversity value shows high potential to drive change. Best practices indicate that investing in creating more and better knowledge on biodiversity, and making it available to the public in a way that makes them appropriate and identify with those values, fosters public mobilization for action to protect biodiversity and engage in collaborative and co-creation processes. Concomitantly, leveraging awareness beyond the public into institutions and policy-making is crucial.

Even though some authors argue for nature-based solutions (NBS) as a "distraction" from purposeful biodiversity protection, best practices show that micro-scale NBS are more accessible to local populations and should not be discarded. The multiplication of these actions shows potential to densify the network of spaces for biodiversity and increase general awareness levels.

The best practices also ascertain that biodiversity is not a niche issue. Integrating biodiversity into the spatial planning process goes hand-in-hand with the integration of other environmental policies. Biodiversity depends on the geo-system, including water, soil, and air regulation. Thus, there is evidence in the best practices that interlinking policies benefits from an ecosystem approach. Embracing and valuing people's on-site actions within the broader ecosystem seems to be a prerequisite for more effective integration of biodiversity in the planning process, calling for the development of a Nature-Based Planning (NBP) culture.

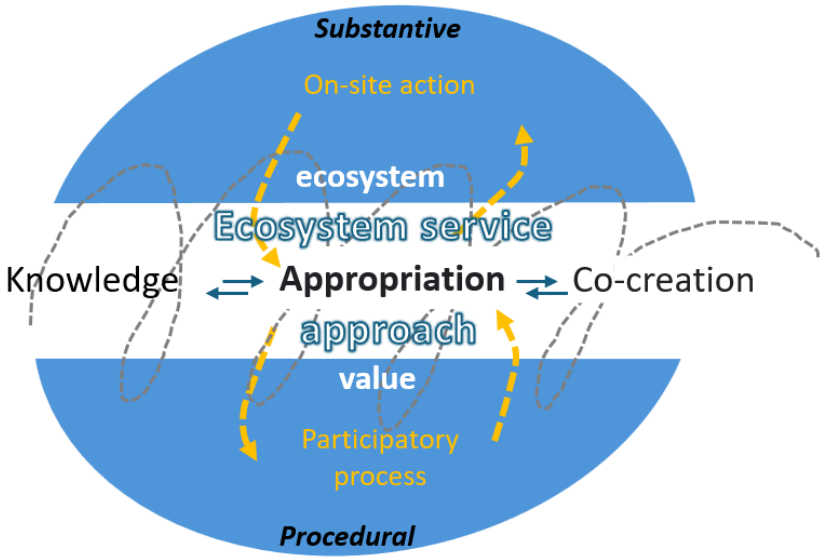

Figure 14: Key-learnings from BP analysis

Referring to the key learnings from the analytical process (Figure 14), "appropriation" appears to be the centerpiece of integrating biodiversity in the spatial planning process, as it connects the

substantive and the procedural dimensions through action on ecosystems within participatory processes. This being said, the transformative potential may rely on the way people and communities are systematically embedded in the planning process.

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Appendix A: Questionnaire

Questionnaire of Best practices

We would like to benefit from your knowledge and experience by collecting information about best practices regarding instruments/projects to preserve biodiversity in the context of spatial planning. The information is for research purposes for the BioValue project.

Read more about the BioValue project

This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101060790.

* Indica uma pergunta obrigatória

1. Currently, how much do you think spatial planning contributes to halt the loss of biodiversity?

   Marcar apenas uma oval.

   1 2 3 4 5 6 7 8 9 10

   Not ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ ◯ Contributes so much

2. Please name one or more good examples of instruments, policies and/or projects that show significant or potential improvements in halting biodiversity loss in the context of spatial planning. **Please refer the country of the example.**

3. What do you think is special about it?

4. Are you currently involved in any of these fields of activity?

Marcar tudo o que for aplicável.

- [ ] Architecture
- [ ] Landscape architecture
- [ ] Urbanism
- [ ] Planning
- [ ] Environment
- [ ] Policy Making
- [ ] Engineering
- [ ] Economics
- [ ] Social Sciences
- [ ] Education
- [ ] Management
- [ ] Agriculture
- [ ] Others

5. Are you involved in any of these type of organizations?

Marcar tudo o que for aplicável.

- [ ] Private company
- [ ] Consultancy company
- [ ] Non governmental organization
- [ ] Education, universities or research centers
- [ ] Others

6. In which country(ies) are you active?

_____

7. How did you find this survey?

Marcar apenas uma oval.

- ◯ In a conference
- ◯ Via membership list of a network
- ◯ BioValue website

8. If it was via membership list of a network, which organization sent the information?

_____

9. Thank you for your contribution. If you agree that we may contact you for more details, please provide your e-mail address

_____

10. First and last name

_____

11. Please read in here our privacy policy and confirm if you agree. In there you can find our principles of anonymity, confidentiality, voluntary participation and the team leader contact information *

Marcar apenas uma oval.

- ◯ Yes, I agree
- ◯ I don't agree

Appendix B: Semi-structured Interview

(Topic 1) – What is your position in the organization and background (professional)

(Topic 2) - What do you consider to be the main causes of biodiversity loss? And what is the context? (European/global)

NOTE 1: From now on we would like to focus the interview in the context of planning

(Topic 3) - How does your organization position itself regarding the preservation and/or improvement of biodiversity and territorial planning?

(Topic 4) - What are the difficulties/bottlenecks that prevent biodiversity conservation in the context of planning?

NOTE 2: List of bottlenecks to guide the question.

Examples: Information (lack of), Financing (lack of), Cross-sectoral communication, Societal demands, Regulations (lack off), Science policy communication/dissemination, Lobbies and economic interests, Common sense/knowledge (lack of)

(Topic 5) - Given these bottlenecks, are there good examples where effective integration can be observed?

(Topic 6 – only for those who consider it useful) - Do you consider that there is a gap between the objectives and results of the SP/SP system in relation to biodiversity?

(Topic 7 – only for those who consider it useful) (where?) In which part of the planning process does this happen? (Vision/territorial model/plan formalization/Validation) and at what planning scale (national, regional and local)

(Topic 8 – final question) - What do you think should be done to better integrate biodiversity with planning? (Policy, research, education, information/communication)?

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