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

Horizon scanning for knowledge needs and research prioritisation

D3.3: Cookbook for support structure(s) of research prioritisation, open consultations and knowledge needs.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Meaning / Full text
Alternet	A European network for biodiversity research
Biodiversa+	European Biodiversity Partnership
CBD	Convention on Biological Diversity
DG	Directorate-General
DG ENV	Directorate-General for Environment
DG RTD	Directorate-General for Research and Innovation
EC	European Commission
EEA	European Environment Agency
Eklipse	EU Science-Policy-Society Interface for Biodiversity and Ecosystem Services

EPBRS	European Platform for Biodiversity Research Strategy
EU	European Union
EUBP	European Biodiversity Platform
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
KCBD	Knowledge Centre for Biodiversity
KEN	Knowledge Exchange Network
NBS	Nature-based solutions
NetworkNature	European Platform for Nature-Based Solutions
NINA	Norwegian Institute for Nature Research
REA	European Research Executive Agency
R&I	Research and Innovation
SRIA	The Strategic Research & Innovation Agenda
SSBD	Science Service for Biodiversity

BACKGROUND: ABOUT THE BIOAGORA PROJECT

BioAgora is a collaborative European project funded by the Horizon Europe programme. It aims to connect research results on biodiversity to the needs of policymaking in a targeted dialogue between scientists, other knowledge holders and policy actors. The project's main outcome will be the development of a Science Service for Biodiversity. This new service will fully support the ecological transition required by the European Green Deal and the European Union's Biodiversity Strategy for 2030.

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

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EXECUTIVE SUMMARY

This document is a deliverable of the BioAgora project, funded under the European Union's (EU) Horizon Europe research and innovation programme under the grant agreement No. 101059438. The aim of this document is to explore processes, methods and actors related to horizon scanning for knowledge needs and research prioritisation, and, based on lessons learned, provide recommendations for creating more effective horizon scanning and research prioritisation processes in Europe, particularly for the Science Service for Biodiversity.

We mapped and interviewed the past and present core actors working on horizon scanning for knowledge needs and research prioritisation around biodiversity, particularly the European Platform for Biodiversity Research Strategy (EPBRS), the European Commission (EC), Biodiversa+, and Eklipse, as well as consulted relevant literature to identify challenges and opportunities. In addition, we tested different approaches for scanning the horizon for research needs and prioritising them. Seven core lessons learned were identified in this process:

1. The landscape of actors is complex, and major orchestration opportunities remain to utilize synergies and avoid duplication.
2. Research prioritisation exercises around biodiversity often lack transparency and/or low inclusiveness.
3. The processes of horizon scanning for knowledge needs and research prioritisation around biodiversity are often biased towards natural sciences, while solving biodiversity issues may require prioritising research for biodiversity across disciplines, fostering inter- and transdisciplinary research, including social sciences.
4. Politics of knowledge is an unavoidable part of mapping and prioritising knowledge needs, which is crucial to acknowledge to ensure it does not interfere with effective research prioritisation but supports tackling biodiversity challenges in most effective ways.
5. Goals and criteria of ranking research priorities are not always clear in research prioritisation exercises around biodiversity, which may hamper the effectiveness of these exercises.
6. Time and capacity constraints are a major reason for the above-described challenges as actors rarely have time to tackle them.
7. Cognitive biases may hinder effective processes of horizon scanning for knowledge needs and research prioritisation for biodiversity, yet these biases are hardly ever accounted for in such exercises.

To tackle these challenges, we recommend the Science Service for Biodiversity to:

1. Acknowledge and orchestrate the existing landscape of actors rather than create potentially competing, new actors.
2. Conduct and support transparent and inclusive processes of horizon scanning for knowledge needs and research prioritisation.
3. Seek to map and prioritise research needs across disciplines to tackle real-life biodiversity challenges rather than prioritise research in pre-defined disciplines.
4. Tackle politics of knowledge in research prioritisation by higher transparency and transformative change, for example by re-thinking the existing power structures.
5. Rigorously specify the goals and ranking criteria for research prioritisation exercises around biodiversity to ensure their practical relevance.
6. Seek to increase time and capacities available for research prioritisation around biodiversity.
7. Account for cognitive biases, test their effects on research prioritisation around biodiversity and design future prioritisation exercises to avoid potentially problematic biases.

With these recommendations, the Science Service for Biodiversity will adequately support effective knowledge need scanning and research prioritisation which effectively supports the EU biodiversity goals (see Chapter 7 on how this can be done in practice).

NON-TECHNICAL SUMMARY

This document explores how knowledge needs are mapped and priorities set to support biodiversity, and suggests ways to improve these processes in Europe, particularly for the future Science Service for Biodiversity, which is aiming at aiding EU in reaching its biodiversity targets.

We studied key organizations involved in horizon scanning for knowledge needs and research prioritisation for biodiversity and reviewed past efforts to understand the main challenges and opportunities. We also tested different approaches for identifying and ranking research needs. Through this process, we found that the landscape of actors working on biodiversity research prioritisation is complex, and better orchestration is needed to avoid duplication and make the most of the existing efforts. Many prioritisation exercises lack transparency and inclusiveness, limiting their effectiveness. In addition, research in this field tends to focus mostly on natural sciences, even though addressing biodiversity challenges requires contributions from multiple disciplines. Political influences can also shape research priorities, making it crucial to ensure decisions are based on what will have the greatest positive impact on biodiversity rather than on competing interests. The lack of clear goals and ranking criteria can further reduce the effectiveness of prioritisation efforts. Limited time and resources make it difficult for organizations to fully address these issues. Cognitive biases may also affect decision-making in research prioritisation, yet these biases are rarely accounted for.

To improve research prioritisation for biodiversity in Europe, we recommend the Science Service for Biodiversity to work with existing organizations rather than creating new ones that compete for the same role. Decision-making should be more open and inclusive, ensuring that research priorities reflect a broad range of perspectives. Efforts should also extend beyond natural sciences to tackle biodiversity challenges more effectively. Transparency should be increased to prevent political influences from distorting priorities, and the criteria for ranking research should be clearly defined to ensure meaningful outcomes. Additionally, more time and resources could be allocated to research prioritisation efforts, and potential biases in decision-making should be recognized and addressed.

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1. Introduction

Amid the escalating biodiversity crisis, the European Union (EU) faces critical decisions on what research to fund to meet the targets of its Biodiversity Strategy for 2030. Recognizing the urgency for action, the BioAgora project has been tasked with designing a functionable Science Service for Biodiversity (SSBD), a science-policy interface platform which will be the scientific pillar of the EU's Knowledge Centre for Biodiversity (KCBD) that enhances the knowledge base, facilitates knowledge sharing and fosters cross-sectorial policy dialogue for EU policymaking in biodiversity and related fields. As part of transforming processes within and between science and policy, the SSBD is to support the EU in horizon scanning for knowledge needs and research prioritisation for biodiversity, to guide effective Research and Innovation (R&I) policies (see also Nesshöver et al. 2016). The aim of this Cookbook is to provide strategic recommendations for establishing how BioAgora/SSBD can provide this support and guidance.

The recommendations of this Cookbook are based on systematic exploration of the actors who currently participate in the processes of horizon scanning for knowledge needs and research prioritisation for biodiversity in the EU, interviews and other interactions with these actors, and literature review. These exercises are presented in Chapters 2, 3 and 4, respectively. In addition, we have commenced testing different research prioritisation approaches in two Knowledge Exchange Networks (KENs—Freshwater and Nature-based Solutions) which feature real-world applications designed to showcase how SSBD may support evidence-based biodiversity policymaking, presented in Chapter 5. In Chapter 6, we draw together all these exercises and describe central lessons learned, which are then brought together in Chapter 7 with a decision tree on methods for exercises that scan the horizon for knowledge needs and/or prioritise research, and actionable recommendations on how to enhance the effectiveness of research investments in addressing biodiversity loss in Europe.

The recommendations of this Cookbook can support any individuals, groups and institutions involved in processes of horizon scanning for knowledge needs and research prioritisation for biodiversity, ranging from local research groups to the level of the European Commission (EC), as detailed in Chapter 2. Yet, the recommendations are mainly aimed at guiding BioAgora in developing the function of horizon scanning for knowledge needs and research prioritisation for SSBD through 1) testing different knowledge needs mapping and prioritisation methods in new BioAgora KENs (i.e., Landscape KEN, Transformative Change KEN, Monitoring and Scenarios KEN, and future KENs); 2) structuring the function of horizon scanning for knowledge needs and research prioritisation, to be carried on in SSBD after BioAgora project concludes; and 3) responding to knowledge synthesis requests from Directorate-General (DG) R&I which may entail listing topical knowledge needs and priorities. As stated by Action 80 of the EU Biodiversity Strategy for 2030 (European Commission 2020), EC is committed to establishing a Long-Term Biodiversity Research Agenda to support the funding allocation for Horizon Europe calls on biodiversity and is expected to request the support of BioAgora/SSBD for this. By contributing to these three activities, this Cookbook supports BioAgora project objectives 1 and 2, providing "tailored pathways on how to better orchestrate knowledge and research needs from policy, the identification of knowledge gaps and the existing science-policy interfaces" and understanding "actual and emerging research and policy needs by lessons learnt and horizon scanning process".

The Cookbook is deliberately scoped to focus on horizon scanning for knowledge needs and research prioritisation—activities aimed at identifying and prioritising important research topics and/or questions, i.e., answering the question: "What research should be conducted for a given purpose?". Thus, we do not address the practical procedures of answering requests process in general nor prioritisation between the different requests which BioAgora and the future SSBD receive through the ticketing system of the KCBD. Additionally, while the Cookbook touches on foresight and horizon scanning methodologies, it does so exclusively in cases where these methodologies are applied to establish research priorities. As such, the Cookbook is not intended to guide foresight or horizon scanning exercises aimed at other objectives, such as alerting policymakers to emerging threats to biodiversity. To adapt to the changing research prioritisation landscape and new lessons learned emerging from the BioAgora project, this Cookbook may be updated with an addendum before the end of the BioAgora project (June 2027).

The development of the Cookbook is coordinated by BioAgora Task 3.3, "Assessing future knowledge needs and horizon scanning", conducted during project months M3-M54 and led by NINA, with contributions from UniTrento, UFZ, UNIBUC, Syke, IGB, UNEP-WCMC, INRAE, PBL, UKCEH, ERCE, CREAF and INBO. We also explore the transformative change aspects in the context of the structuring of SSBD developed by Task 2.3 (D2.3), tackling the root causes of biodiversity loss. These transformative change aspects involve:

- The principles of plurality of knowledge and perspectives,
- Empowering capacities for change,
- Politicizing and discussion of power, and
- Embedding for iterative learning and collective action in institutions and networks.

We also discuss the pathways to collaborate, disrupt and challenge the prevailing structures of horizon scanning for knowledge needs and research prioritisation for biodiversity. These transformative aspects are integrated in Chapters 6 and 7. Furthermore, in Chapters 6 and 7 we also take advantage of the topical expertise of Task 1.3 Monitoring and Scenario KEN and of Task 1.4 on horizon scanning and foresight methods.

2. Landscape of actors

The network of actors driving the processes of horizon scanning for knowledge needs and research prioritisation for biodiversity in Europe involves diverse stakeholders, including EU institutions, national research agencies, policymakers, funding agencies, NGOs, and interdisciplinary experts. This chapter maps the network of actors and examines existing coordination practices. By applying stakeholder mapping, literature reviews, and expert interviews, the analysis identifies key gaps, overlaps, and inefficiencies that currently impede the effective horizon scanning for research needs and research prioritisation for biodiversity. Highlighting these critical areas sets the groundwork for targeted recommendations aimed at improving collaboration and inclusivity, and ensuring sustained policy impact.

2.1 Methods

For developing the network of actors, we first extracted the funding agencies and actors mapped in D2.1. Next, we screened the EU Biodiversity Strategy for 2030 and made a list of search options based on the terms used in the strategy (e.g., soil health, restoration, forestry, agroecology), each of which was then run through Google search. The first two results pages were further screened to identify relevant actors (i.e., institutes, organisations, groups) mentioning that they are involved or have recently been involved in horizon scanning activities for knowledge needs and/or research prioritisation related to biodiversity. In addition, we explored ~200 scientific papers to identify additional actors that have been conducting research prioritisation exercises (for the detailed methods, see Chapter 4). In these two search exercises, individual research groups were excluded to maintain the focus on institutional-level actors.

To get a more detailed image of potential synergies, overlaps and connections between different research prioritisation actors, as well as to define how to best activate and sustain an effective, inclusive, and policy-relevant network of actors, we interviewed key persons involved and working for the former European Platform for Biodiversity Research Strategy (**EPBRS**) which shaped the early efforts of research prioritisation for biodiversity in EU. Active between the late 1990s and mid-2010s, EPBRS played a key role in supporting EC with creating Horizon calls through its prioritisation efforts and fostered collaborative dialogue between policymakers, scientists, and stakeholders to identify priority areas. Additionally, interviews with EPBRS representatives (Chapter 3) helped identify other core actors which contribute to research prioritisation today, who were subsequently invited for interviews (using a snowball sampling approach).

Furthermore, we analysed 18 publicly available Eklipse reports, systematically screening them for explicit mentions of research prioritisation activities using predefined keywords: ‘research needs', 'research gaps', 'knowledge needs', 'knowledge gaps.’ 12 of the 18 reports identified through this keyword search were reviewed to determine if and how Eklipse conducted research prioritisation (Annex I).

2.2 Results

The network of actors related to research prioritisation for biodiversity comprises a diverse range of stakeholders, including European and national research networks and institutions, funding agencies, and governmental and intergovernmental bodies (Table 1). The network of actors database will be updated throughout the BioAgora project period and will be uploaded to the SSBD platform where it will form a community ready to be involved for relevant requests. After the active days of EPBRS, research prioritisation has become a more distributed effort, with various actors contributing in parallel.

Table 1. *Overview of actor types of the initiatives, networks and organisations which are dealing with horizon scanning for research needs and/or research prioritisations and which came forward in our online search.*

Actor type	Number of initiatives, networks, organisations
Science-based communities or networks (inc. citizen science)	29
Intergovernmental / international organizations or agencies	15
Government-related organizations or agencies	14
Science-policy or science-policy-society platform	9
Funding bodies for research or environmental funds	7
EU funded projects	4
Think tanks and para-research organizations (e.g. policy analysis)	4
Data platforms and research infrastructures	4
Business / sectoral organizations and private interest groups	3
Total	89

Currently, the **EC** plays a key role for biodiversity-related research prioritisation through the creation of Horizon Europe calls together with national Programme Committees, particularly Cluster 6 on "Food, Bioeconomy, Natural Resources, Agriculture and Environment" which addresses biodiversity-related challenges. This Cluster has its basis on the periodic strategic plans, co-created by DG RTD (Directorate-General for Research and Innovation) and DG ENV (Directorate-General for Environment) (European Commission 2023), and in the future, will also incorporate insights from the Long-Term Biodiversity Research Agenda.

Biodiversa+, one of the key European networks for biodiversity research, conducts its own prioritisation exercises (Eggermont et al. 2021) which feed directly into its own calls and potentially indirectly into other (trans)national research funding schemes.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (**IPBES**) contributes indirectly to research prioritisation through its global assessments which include listing of knowledge gaps that may influence both EU-level and regional funding priorities. These gaps are also available in an open database.

The Cooperation for the Convention on Biological Diversity (**CO-OP4CBD**) Horizon Europe project collaborates with CBD National Focal Points to identify knowledge and capacity needs for improved implementation of the Kunming-Montreal Global Biodiversity Framework. It advances the capacities of experts on CBD processes, mechanisms, and on agenda items of the Subsidiary Body on Scientific, Technical and Technological Advice to enable improved involvement in CBD processes.

The **EuropaBON** project worked with stakeholders to identify user and policy needs for biodiversity monitoring which will potentially be continued by the proposed EU Biodiversity Observation Coordination Centre (**EBOCC**; Liquete et al. 2024) aiming at improving EU biodiversity data collection, integration and mobilisation to optimize existing observation efforts, harmonize

data, and enhance the ability to predict and respond to key challenges related to European biodiversity loss.

In addition to these core actors with systematic and sometimes repeated prioritisation exercises, various other actors run occasional or one-time knowledge need mapping and/or prioritisation exercises, including but not limited to:

- **Academic institutions** and **research groups** which often aim at drawing funding or scientific attention to specific research fields;
- **NGOs** which often aim at drawing funding or scientific attention to specific biodiversity challenges;
- **National government bodies** which often aim at supporting the creation of national funding schemes;
- Advisory bodies, such as **Eklipse** and the European Union Biodiversity Partnership (**EUBP**) (and other EU working groups), which may identify research gaps as part of their advisory mandates.

The interviews identified coordination challenges across EU, national and regional levels, causing fragmented resource allocation and difficulty in effectively aligning research priorities. Consultation fatigue emerged as a major issue, as stakeholders are often simultaneously involved in multiple overlapping initiatives, limiting their meaningful participation. While key institutions such as Biodiversa+ and EC DGs play a central role in shaping research priorities, broader inclusion of smaller organizations and practitioners remains a challenge in the agenda-setting process. Furthermore, limited inclusion of transdisciplinary perspectives, particularly social sciences and local knowledge systems, narrows the scope of prioritisation efforts. Despite the potential of digital platforms to enhance stakeholder engagement, traditional methods continue to dominate, creating ongoing challenges related to accessibility and efficiency.

3. Insights from the actors

To map typical methods, synergies, orchestration opportunities, and lessons learned, we interviewed and interacted with diverse actors that have participated in the processes of horizon scanning for knowledge needs and research prioritisation for biodiversity in the EU (identified in landscape of actors, Chapter 2).

3.1 Methods

We conducted 11 semi-structured interview sessions with 15 experts from **EPBRS**, **DG RTD, European Research Executive Agency (REA), DG ENV, Eklipse and**, **Biodiversa+** (Table 2, to get a detailed information on how the past and present key actors have run exercises to scan the horizon for knowledge needs and research prioritisation, as well as what lessons they have learned in the process. All interviewees hold or had been holding key management positions in their respective institutions. The interview questions were tailored to each actor and are presented

in Annex II. Due to time constraints, we were not able to interview core persons from **IPBES**, thus the results on their methodologies are based on written reports and comments from other interviews.

Table 2. *Interviews conducted to map how the past and present core actors conducted research prioritisation exercises as well as what lessons they have learned in the process.*

Actor	Interview dates	Interview type	No. of representatives
EPBRS	2.3.-10.9.2023	Single interviews	5
DG RTD (EC); REA	19.12.2023; 29.1.2024	Group interviews	2
DG ENV (EC)	4.1.2024	Single interview	1
Eklipse	24.5.2023	Group interview	3
Biodiversa+	10.9.2024; 9.10.2024	Group interviews	4

In addition, we further interacted with **DG RTD, EUBP, KCBD, DG Env** and **Alternet** by following ways:

- We discussed research prioritisation with **DG RTD** in spring 2023 at various BioAgora meetings and continued at a dedicated meeting on 23 August 2023 where we discussed the plans and synergies between Task 3.3 and DG RTD work on research prioritisation. Both Task 3.3 partners and DG RTD expressed interest in more in-depth pre-submission dialogue meetings for preparing DG RTD requests to the ticketing system and for providing BioAgora's contribution to the Long-Term Biodiversity Research Agenda. As per today (April 2025) no pre-submission dialogue between DG RTD and Task 3.3 has taken place. During the BioAgora Consortium meeting in Cambridge, November 2024, Task 3.3 presented preliminary results, and DG RTD presented its vision for the Long-Term Biodiversity Research Agenda and the intention on submitting their request to the ticketing system.
- Task 3.3 participated in an **EUBP** info event on 29 June 2023 where research prioritisation aspects were brought up. Additionnally, BioAgora participated in a workshop organized by **DG ENV** (Brussels, 14 November 2023) to consult EUBP for research priorities.
- Task 3.3 discussed with **KCBD** about SSBD functions and structure throughout 2022-2024 at various meetings, as well as at a specific meeting between KCBD and Tasks 3.1 and 3.2 on 27 June 2023.
- Task 3.3 participated at **Alternet**'s Reflection Dialogue on Scientific Needs and Prioritisation, organized virtually on 30 October 2024.

We sought to understand how other organizations may be involved in research prioritisation activities and whether BioAgora and the SSBD could benefit from understanding their methodologies by asking **14 other organizations** (see 3.2.8 for a list) whether they were involved in horizon scanning and/or identifying knowledge needs/research gaps. This was done under BioAgora Task 2.1 in 2023, assessing the community of key actors for Biodiversity Strategy for 2030. A more detailed description of the methods of these interviews is available in D2.1.

3.2 Results

This section presents descriptive summaries from the above-described interviews and other interactions for each actor.

3.2.1 EPBRS

The responses and comments related to advice for BioAgora and the SSBD are listed below in priority order, based on how many interviewees mentioned them. The responses related to EPBRS structures and functionality are sorted under five post hoc topics (origins, selection of participants, meeting procedures, funding, and linkages to other bodies), presented in Annex III.

Strengthen interdisciplinarity (5/5): All interviewees brought up the issue that most of the EPBRS processes and expertise were concentrated around direct biodiversity sciences and/or other natural sciences. Natural sciences and scientists, however, were not expected to have tools and capacities to deal with and incorporate societal and political aspects when considering research priorities, and thus interdisciplinary expertise, particularly from social scientists, e.g., psychologists, remains crucial. When social scientists were involved in EPBRS activities, their input was critical, particularly in the stage of writing the draft recommendations on knowledge needs and prioritisation, when there was a need to make scientific questions societally and politically relevant. Yet, it was always a challenge to find social scientists to participate in EPBRS activities, and thus societal aspects always remained mostly in the background. Furthermore, it is important to reach beyond science to policymakers and other sectors of the society. However, policy representatives also tended to withdraw from EPBRS processes. Often, it is not the lack of natural science knowledge that stands in the way of action. As put by one interviewee, if you only ask what natural sciences will strengthen the biodiversity policy implementation, "*you are setting yourself up for a failure",* meaning such question is inevitably biased. Particularly, the interviewees pointed towards current research needs in the field of psychology and sociology, historical and anthropological knowledge, barriers to transformative change, and better connections to economy and finances (e.g., alternative, more sustainable monetary systems).

Adapt to the current landscape (5/5): All interviewees pointed out that potential new research prioritisation structures of SSBD would have to adapt to the existing landscape, and that the former EPBRS-model may not fit for the current conditions and could lead to potential overlaps with ongoing initiatives. Particularly, a potentially revived EPBRS-like process should adapt to and collaborate with Biodiversa+, CBD, EC DG RTD and DG ENV, IPBES, European Environment Agency (EEA), and recurring Horizon scanning activities, as well as to adapt to current policy needs. One also needs to consider the potential issues of trust and power with other actors. Mapping the existing landscape of actors is crucial for deciding whether and how new research prioritisation structures should be set up. There have already been attempts to continue and recover EPBRS after the end of its active days, but due to the existence of overlapping activities (Programme Committees), lack of finances and the lack of one or more dedicated persons coordinating such initiative, these attempts did not follow through.

Secure core funding (5/5): All interviewees pointed out the importance of secured, continuous core funding, particularly for the administrative body of a potential new prioritisation structure and for covering participants' travel and accommodation to in-person prioritisation workshops, especially for participants from less wealthy countries. Interviewees mentioned different potential sources of such funding, including the EC, European Parliament, and EU member states. The funding structure should not burden any country or partner in particular; i.e., the Belgium Platform pulled EPBRS alone for a long time, and in the lack of clear incentives and monetary support from the EC, they had to deprioritise this activity.

Develop community and capacities (5/5): Even though EPBRS never had a specific aim of capacity and community building, all interviewees mentioned these as central outputs of the EPBRS processes (e.g., repeated face-to-face interactions, community creation, related trust and open discussions). One of the interviewees even pointed out that the capacity building was likely the most important output of EPBRS that shaped the development of the biodiversity research and policy landscape. One problem of the current science-policy interface-landscape pointed out by the interviewees is that people do not have time to engage and keep in touch as much as would be required for effective reflections.

Ensure legitimacy (4/5): Four interviewees mentioned the importance of ensuring legitimacy. Having delegates from each EU member state and associated members enforced the political position of EPBRS, and countries are more willing to act along recommendations if their government has been involved in the process of creating them. To ensure SSBD's legitimacy, it needs to have continuous support from the EC. It would likely be difficult to provide countries with specific instructions on how to select representatives for a potential new EPBRS without reducing the sense of legitimacy, although perhaps experts could be chosen with a more open and inclusive process.

Engage key people (3/5): Three interviewees pointed out that much of the EPBRS success was due to key individuals, for example through dedication, charisma, persuasion skills, leadership capabilities, position, and affiliation, which allowed the individual to use his/her work time on EPBRS activities. The key for securing funding and political impact is to identify and engage the right people with these characteristics.

Find a clear audience (3/5): Three interviewees said it was crucial for the success of EPBRS to have EC and/or countries as a clear audience or "client" with a clear need for the recommendations of EPBRS. EC was involved in coordinating EPBRS from the start, so the EPBRS recommendations fed straight into the funding calls around biodiversity. This is a clear difference between EPBRS and IPBES where the latter does not have a clear client when it comes to the implementation of the research gaps resulting from the different IPBES assessments. Also, for the SSBD, it should be clear to whom the prioritisation results are communicated to.

Arouse and seek interest (2/5): Two interviewees suggested that it is important to find and engage actors which have an interest in research prioritisation. In Belgium, there was already a political will to allocate more money towards biodiversity issues, making it easier to get financial support from the government for setting up the national biodiversity platform. One could consider

finding those institutions which would benefit from new research prioritisation structures and discuss with them why and how it could be done.

Deliver outputs at the right time and format (2/5): Two interviewees pointed out that it is crucial to have the outputs ready at the right time and in a concise, clear format, as well as to be involved in the political processes early when there are still opportunities to have an effect. Some EPBRS recommendations were taken up in the past because they fit the ongoing political processes, while other mistimed EPBRS recommendations were less impactful.

Enable participation by policymakers (2/5): Two interviewees pointed out that it was a challenge to engage policymakers who often had troubles justifying travelling to research prioritisation meetings. Particularly, this was challenging when EPBRS tasks were not included in their job description, and/or if the overall image of the meeting was "mainly scientific" and falling outside policymakers' job. Concentrating the meetings around tangible policy relevant issues could potentially increase policymakers' participation.

Favour light governance structure (2/5): Two interviewees said they would prefer a light governance structure for the research gaps and prioritisation function of the SSBD. It would be better to have something more EPBRS-like and informal rather than something time consuming where member states and associated members hold up processes, outcomes and uptakes.

Other advice (1/5): Advices brought up by only one interviewee each are listed in Annex IV.

3.2.2 EC

Relevant Horizon Europe funding calls related to biodiversity research are included in Cluster 6: Food, Bioeconomy, Natural Resources, Agriculture and Environment, but other Clusters (e.g., Cluster Health, Cluster Climate, Energy and Mobility) also include biodiversity-related themes. The basis for the content of Cluster 6 is defined by the legal framework and the Horizon Europe Strategic Plan 2025-2027 Analysis report, created under the lead of DG RTD with contributions from other DGs. In practice however, the calls are formulated by so-called co-creation groups of different EC services, including the leading DGs of the Cluster (DG ENV, DG Agri, DG RTD), as well as any other DG that may have interest in biodiversity co-creation (e.g., DG Mare, DG Clima). Also, DG RTD invites REA and European Research Council Executive Agency to participate in these processes. People from these institutions co-create the programme topics. The process depends mainly on how the people in co-creation group organize themselves, yet the work is steered by the Secretariat of the Cluster that maintains the coherency of the process and that is overseen by separate committees which ensure that the legal rules are followed.

In the co-creation processes, the various EC representatives feed in their views on what research is considered important, which may be based on, e.g., personal experiences, connections to researcher groups and research projects, existing or upcoming biodiversity-relevant policies, or conferences the representatives have attended. In addition, priority criteria assisting in priority setting include significance of research, urgency, technical feasibility, economic feasibility, co-benefits across multiple sectors, and whether they address the drivers of biodiversity loss,

contribute to international biodiversity agenda and conventions, and bring added value to EU and synergies with R&I partnerships and missions. Based on personal competencies, there may or may not be experts among the representatives for certain research areas when formulating the calls. At the end, the content needs to go into an interservice consultation where all DGs agree on it.

Additionally, EC consults the Programme Committees of the EU member states for views on important research needs (member states and associated members may also run internal, country-level consultations which feed into the Programme Committees, but this work is not overseen by the EC and differs per member). Furthermore, EC may run public consultations (as part of the analysis reports on research needs) and/or consultations of other bodies, such as the EUBP sub-groups and their relevant coordinators, but so far, resources for such consultations have been limited, neither is there sufficient time to systematically extract knowledge needs from, e.g., reports and scientific literature. Biodiversa+ is represented in the EUBP but is not elsewise formally consulted nor has any voting rights and does not participate in the formulation of recommendations or advice of the Platform and its sub-groups. Because EC accounts for its outputs in co-creation processes, external bodies such as NGOs may also send in their opinions for consideration.

There are internal guidelines for how the co-creation and consultation processes work, yet most of them are confidential and only shared with participating entities such as the member and associated member state representatives of the Programme Committees. The legal basis is open for the public, including the rules and procedures, but these do not describe how the methods work in practice.

In the future, the funding related to biodiversity is expected to be steered by the Long-Term Biodiversity Research Agenda, currently being developed by DG RTD. The processes which feed into this Agenda are not open to public, but BioAgora and the SSBD are likely to be consulted.

With regards to developing structures for the SSBD, the interviewees gave the following advice:

- SSBD could support EC with horizon scanning for research needs and in running more systematic analysis of research gaps
- SSBD could help underrepresented European member states to increase their participation in Programme Committee work.
- If a report or other output is fed into research prioritisation processes, they need to be in the right format and delivered at the right time to have an impact.
- It is crucial to improve the engagement of society, citizens and stakeholders in prioritisation exercises, and develop transformative change perspectives.
- It is critical to build trust, community and networks.
- Research gaps identified in the different IPBES assessments could be useful for EU if translated from global to the EU-context.
- Representation in relevant surveys and workshops could be improved to include institutions beyond the well-organized, established research groups, Programme Committees and strong DGs such a DG Agri.

- The Programme Committees vary highly in their biodiversity expertise, and many countries are represented by research and/or agricultural ministries rather than environmental ministries.
- It is important that SSBD avoids duplicating work on identification of research gaps, such as work already done by DGs Committees and Biodiversa+. It is challenging to establish anything such as the former EPBRS because the member and associated member state consultations are now done through the Programme Committees (which includes the legal basis).

3.2.3 Biodiversa+

The European Biodiversity Partnership Biodiversa+ and the EC maintain separate processes for horizon scanning for knowledge needs (often referred to as foresighting by the Biodiversa+ interviewees) and research prioritisation. According to Biodiversa+, their processes have high transparency, while the EC's processes are more undisclosed. To avoid overlaps and foster synergies, Biodiversa+ adjusts its calls based on EC outputs. Although the EC acknowledges Biodiversa+ contributions and utilizes it when creating Horizon calls, the extent of its influence is officially and currently at the observer level in the EUBP.

Biodiversa+ does not directly interact with Programme Committees responsible for Horizon calls. While there may be some overlap in consulted individuals (i.e., member state representatives in the Programme Committees may also be representatives in exercises of Biodiversa+), the extent of the overlap is unknown. Biodiversa+ values maintaining its independence from the EC processes but suggests that the EC could clarify how exactly Horizon calls are shaped. During the interview it was also noted that the exact methods used by Biodiversa+ are not yet available in detail, i.e., the systematic mapping and foresight exercises including literature studies and consultations run for the Strategic Research & Innovation Agenda (SRIA). Exact methodologies are however expected to be elaborated in a Biodiversa+ deliverable in spring 2025.

Coordinating external actors, as BioAgora may anticipate, according to the interviewees, poses challenges. A more effective approach might be to equip the existing actors with the resources and opportunities to self-organize. Research prioritisation should be flexible rather than rely on a single list for all donors. Funding agencies need to identify knowledge needs they can address based on their resources and objectives. If priorities are rigidly ranked, relevant topics might be overlooked.

Despite some actors having more influence, transparency and inclusivity can help balance power dynamics. Open consultations and commenting opportunities serve as "reality checks," allowing also underrepresented groups to voice concerns. Apart from funding the Flagship Programmes of Biodiversa+, the funding agencies such as ministries and national research councils, could well integrate Biodiversa+ results into broader decisions for national funding schemes.

Transparency is essential for effective orchestration and preventing dominant groups from disproportionately steering decisions. A lack of resources often hampers collaboration, sometimes

leading to competition among actors. However, insufficient time or resources should not justify sacrificing transparency. Instead, processes must be designed to be both transparent and practical. To enhance research prioritisation capacity-building efforts are also needed, including training, resource access, and meeting opportunities for funding agencies. Beyond avoiding duplication, the focus of research prioritisation should be on engaging key stakeholders, including the parties that provide the funding. According to the interviewees, EPBRS was less effective in this regard. The central question is: who is impacted by which research, and how can they be meaningfully involved in research prioritisation?

3.2.4 IPBES

IPBES extracts knowledge gaps based on its internal guidelines to authors contributing to the IPBES assessment reports (IPBES, Task force on knowledge and data 2022). These guidelines encourage authors to point to knowledge gaps when they work on the different chapters of the assessment which are then collated into a final chapter and an open database (IPBES 2024). Many funding organizations utilize IPBES knowledge gaps, yet, IPBES does not have a single target client which makes it hard to assess the impact of the gaps they identify on funding call.

3.2.5 Eklipse

The Eklipse mechanism, managed by Alternet, answers to knowledge needs from policy and other societal actors who identify topics or evidence needs and which require in-depth analysis and a consolidated view from science and other knowledge holders. Eklipse's call for request texts were formulated to remain open-ended rather than being based on existing research priorities. If accepted by the Eklipse Knowledge Coordination Body, the received requests are screened by a scoping group, formed by members of the Knowledge Coordination Body, Methods Expert Group and Eklipse Management Body. Based on a preliminary literature review, initiatives screening and a public call for knowledge, the group dialogues with the requester to agree on a final formulation of the request. An inter- or transdisciplinary Expert Working Group is then selected through a public call for experts. With the assessment of Methods Expert Group and Knowledge Coordination Body members, the Expert Working Group selects a combination of knowledge synthesis method(s) to answer the specific request in timeline previously agreed with the requester.

While some selection criteria for accepting a request, such as avoiding duplication and ensuring geographic scope, are straightforward, subjectivity can arise in certain cases. The Knowledge Coordination Body must reach consensus before accepting a request, with potential debates occurring when multiple requests require prioritisation. Subjectivity can also emerge when determining if a requester is sufficiently engaged, as requesters are expected to provide feedback and participate in deliberations.

Horizon scanning for knowledge needs and research prioritisation in Eklipse reports are linked to the selection of method(s), resulting from the request´ type and aim and required resources. The

MAGICKS App supports the Expert Working Group in selecting appropriate methodologies. Expert identification is a key step to ensure that the tailored methods identified by the Methods Expert Group can be applied in answering the request. This selection tool might also be useful for the SSBD.

3.2.6 EUBP & KCBD

Interactions with KCBD (managed by the Joint Research Centre) and EUBP (governed by the EC) indicated that neither bodies are directly involved in research prioritisation nor run systematic or set internal processes for identifying research priorities. During the meetings, it was suggested that the SSBD could potentially be feeding research gaps to the EUBP who might then communicate them to the EC, although EUBP did not express interest in requesting knowledge from SSBD at that time.

EUBP has however been involved in a research prioritisation exercise run by EC. This exercise took place in Brussels on 14 November 2023 and aimed at supporting EC's work on Cluster 6 of the Horizon Europe Strategic Plan for 2025-2027. It gathered EUBP opinions on R&I needs to tackle biodiversity challenges, particularly including the use of different instruments, the possible role of social sciences, humanities and citizen science, international cooperation and open data. At this workshop, EUBP and stakeholders were offered the opportunity to exchange ideas in an informal and co-creative way using roundtable dialogues. The participating 24 people had various backgrounds from research to management, but most participants had natural science as background. Participation depended mostly on participants' affiliations, their budgets, and their distances to Brussels.

3.2.7 Alternet

Alternet, a European biodiversity, ecosystems and their services research network, is not directly related to research prioritisation, but its Reflection Dialogue on Scientific Needs and Prioritisation identified several aspects relevant for the research prioritisation landscape and methodology. At national level, approaches to advocate research agendas and efforts to influence research agendas vary, whether through ministries or directly by engaging with research funding agencies. Increased synchronization and coordination around common research priorities have shown the potential in strengthening national and European research agendas. The importance of addressing health, societal changes, public engagement, political impact of research, interdisciplinarity (including economics and humanities) and other societal aspects were brought up repeatedly, underscoring how research prioritisation needs to reach well beyond biodiversity focus and towards trans-, multi-, and interdisciplinarity. The critical question is where to set boundaries and what not to prioritise, a courageous step as we navigate through societal transformations, and that researchers should look and collaborate outside of their own research boxes to unify and level up much better.

3.2.8 Other organizations

Out of 14 interviewed organizations in Task 2.1, 5 indicated engagement in research prioritisation and 4 in horizon scanning activities; 4 indicated potential involvement in both, but no information on the type of engagement and methods used was provided (Table 3). Therefore, the results do not allow for defining whether these exercises are systematic, nor whether they are conducted by the organization in question or whether the organization is simply involved in consultation processes run by other actors.

Table 3. *Involvement of other organizations in research prioritisation and horizon scanning.*

Actor	Research prioritisation	Horizon scanning
Ecosystem Services Partnership	potentially	potentially
Capitals Coalition	no	no
Institute for European Environmental Policy	potentially	potentially
European Agroforestry Federation	yes	yes
International Network of Basins Organisation	yes	yes
EUROPARC Federation	no	no
IUCN Europe	yes	yes
Wetlands International Europe	no	no
Copa-cogeca	yes	no
CEEweb for Biodiversity	yes	no
Partnership for European Environmental Research	no	no
Integrated European Long-Term Ecosystem	no	yes
European Network of Freshwater Research Organisations	potentially	potentially
Global Biodiversity Information Facility	potentially	potentially

4. Literature review

4.1 Methods

As the number of published systematic knowledge need mapping and research prioritisation exercises around ecology, biodiversity conservation and environmental sciences has increased rapidly during the past decades (Dey et al. 2020), we ran a search string on Web of Science with keywords on research prioritisation, horizon scanning and biodiversity, including relevant synonyms (e.g., species richness), and extracted ~200 most cited and/or topically relevant papers for a non-systematic manual review returning methods used and lessons learned around research prioritisation for biodiversity. In addition, we reviewed 18 publicly available Eklipse reports, 12 of which explicitly mentioned keywords such as ‘research needs’, ‘research gaps’, ‘knowledge needs’, ‘knowledge gaps’.

4.2 Results

In literature, horizon scanning for knowledge needs and research prioritisation exercises for biodiversity are often referred to as *Delphi*, *participatory processes*, *collaborative research prioritisation*, *expert consultation* (Dey et al. 2020; Mukherjee et al. 2015; Martin et al. 2012), *horizon scanning*, and *foresight* (Cook et al 2014; Bengston 2013) Yet, in practice, highly varying approaches and methodologies are used under these terms both for eliciting research topics and for ranking them. In Table 4 we describe these approaches along with potential methods. Also, in general, there appears to be a lack of systematicity in research prioritisation processes (Lund et al 2022).

Table 4. *Common approaches for systematic research prioritisation. See also Annex I for the methods used by Eklipse.*

Approach	Methods	Examples and references	Output
Elicit research **needs** from **participants**	(online) surveys Interviews Workshops; focus groups discussions; Nominal Group Technique (Mukherjee et al. 2018)	Patiño et al. 2022; Frank & Schäffler 2019; Williams et al. 2022; Horne et al. 2017; Musche et al. 2019; Neve et al. 2018; McWhinnie et al. 2017; Furley et al. 2018; Orr et al. 2022; Hugé et al. 2023; Verrelli et al. 2022; Provencher et al. 2020; Buddenhagen et al. 2023; Parsons et al. 2014; Rivero & Villasante 2016; Pretty et al. 2010; Kramer et al. 2017; Parsons et al. 2015; Taylor et al. 2021; Pittman 2021; Harper et al. 2021; Cigliano et al. 2016; Dicks 2013; Sutherland et al. 2009; Van Dijk et al. 2023	Non-ranked list of research topics
Elicit barriers, future **trends** or other topics from **participants**	(online) surveys Interviews Workshops; focus groups discussions; Nominal Group Technique (Mukherjee et al. 2018)	Sutherland et al. 2023 (Global horizon scan series); Prescott et al. 2017; Dehnen-Schmutz et al. 2018; Oldekop et a. 2020; Sutherland et al 2008; Esmail et al. 2020; Wilson et al. 2010; Buddenhagen et al. 2023; Ricciardi et al. (2017); Aldridge et al. 2023; Herbert-Read et al. 2022; Skórka et al. 2021; Taylor et al. 2021;)	Non-ranked list of future issues or other topics, which will need to be ranked and/or subjectively interpreted to research topics
Elicit research **needs** from **literature**	Run a mapping review and extract gaps suggested by the reviewed sources	For examples in medicine, see Chapman et al. (2013); Wong et al. (2021) Robinson et al. (2011); see also Khalil et al. (2025)	Non-ranked list of research topics

Identify future **trends** with **scenarios** and **projections**	Model based projections using quantitative indicators Visioning and narrative building (expert-based or participatory)	BIOCLIMA developed by DG ENV and DG Clima (3.2.2); Bayesian belief networks (Eklipse)? Leclère et al. 2020 (modelled impact of interventions for bending the curve of global biodiversity loss) Dou et al. 2023 (modelled European land system changes resulting from the prioritisation of different nature values) Pereira et al. 2023 (participatory development of visions and pathways towards desired futures for the high seas)	Future scenarios and trends, expressed with indicators or with qualitative descriptions of the future and pathways to get there, and reflecting priorities chosen by the creators. Results will need to be subjectively interpreted to research topics
Invite participants to rank topics	(online) surveys (voting and scoring)	Dicks 2013; Sutherland et al 2008, 2009, 2017, 2023; Harper et al. 2021; Pittman 2021; Taylor et al. 2021; Kramer et al. 2017; Wilson et al. 2010; Provencher et al. 2020; Aldridge et al. 2023; Cuhls et al. 2022; Gosselin et al. 2020	Ranked list of research priorities or other topics
Use deliberative methods to refine the priorities	Categorize, reformulate, drop, reinstate and re-rank priorities with face-to-face methods	Gosselin et al. 2020	Refined, ranked list of research priorities or other topics

In practice, these exercises typically involve a mix of methods presented in Table 4 e.g., in most cases eliciting research topics from participants is followed by inviting participants to rank topics, often supplemented by face-to-face workshops for creating the final priority list. Simple identification of research gaps does not constitute research prioritisation per se, as mere presence of a research gap is not necessarily indication of its importance (Ventocilla et al. 2018). Depending on the goal(s) of the exercise, highly varying criteria can be used for ranking the research gaps in priority order. The following list is adapted from Hines et al. (2019) and criteria used by EPBRS (3.2.1), EC (3.2.2), Eklipse (3.2.5), and Biodiversa+ (3.2.3, Eggermont et al. 2021):

- Availability of expertise
- Co-benefits across multiple sectors/policies
- Complementarity to other prioritisation exercises or funding schemes
- Economic feasibility
- Effect on other related policies
- Effects on biodiversity
- Effects on most major drivers of biodiversity loss
- Ethical and social issues
- EU level added value
- Evidence

- Evidence of effectiveness
- Expected variation of impact
- Feasibility to answer within politically relevant time frame
- Level of innovation
- Level of ground-breaking aspects
- Level of stakeholder and media interest
- Organisational impact
- Plausibility, technical feasibility
- Potential other effects (beyond biodiversity)
- Relevance in certain time frame
- Relevance policies, agendas, and strategies (see also 3.2.2)
- Scientific novelty
- Size of affected population or local/global relevance
- Stage of development
- Urgency.

Overall, there is high variation in the size and composition of the groups involved in these exercises relevant to biodiversity (Dey et al. 2020). Dey et al. (2020) have identified the number of topic contributors in ecology, biodiversity conservation and environmental science research to range between 13–893 (average 73.5) and the number of topic prioritisation participants between 13–352 (average 38), consisting of mostly academics and government representatives, while other groups, such as funding agencies, rarely participate.

In addition to the above-described methods, other specific approaches may be taken depending on the goal of the exercise:

Prioritising areas, habitats, species, and conservation actions: If an underlying assumption is made that particularly vulnerable, risky, desirable or ecologically central areas, habitats, species or conservation actions are also priority targets for research, various data-based methods can be used to identify and rank these topics, including but not limited to Systematic Conservation Planning (Pressey & Bottrill 2009), Multi-Criteria Decision Aiding (Digkoglou et al. 2024), gap analysis (Maxwell et al. 2009), Conservation Area Prioritisation through Artificial Intelligence Networks (Antonelli et al. 2021), and species-specific prioritisation frameworks (e.g., IUCN Red List). Various data-driven analysis approaches are also used to identify priority alien species (see e.g., Kendig et al. 2022, Peyton et al. 2020, Roy et al. 2019, and Tsiamis er al. 2020).

Prioritising monitoring efforts: Another specific prioritisation approach is to presume biodiversity monitoring as a key to reporting to the EU policies such as the Birds and Habitats directives, the legal basis of Natura 2000. To identity which species need priority of action and research on how to work in effective monitoring using new research and new technologies, the EuropaBON project developed the Essential Biodiversity Variables. With the help of EBVs it is possible to assess current monitoring efforts in Europe, identify data gaps, and address workflow bottlenecks based on the EBVs with a monitoring-specific prioritisation approach. The monitoring specific prioritisation approach entails a four-step user-centred stakeholder engagement process and includes a public online stakeholder conference, online survey distributed across Europe, interviews, and a policy expert workshop (Morán-Ordóñez et al. 2023).

Furthermore, **machine learning** and **artificial intelligence** may have potential to transform the mapping of knowledge gaps in biodiversity. By employing natural language processing to analyse scientific papers, websites and policy documents, underexplored topics could potentially be rapidly identified (Baviskar et al. 2021). These tools could streamline the traditionally labour-intensive process of gap identification, enhancing efficiency. Yet, besides some early attempts to run horizon scanning processes by text mining (Rudd 2017), such automatized tools remain underexplored in the field of research prioritisation for biodiversity.

In addition to these methodological aspects, the literature search also identified other lessons learned which are referred to in Chapter 6.

5. Testing methods to identify and prioritise knowledge needs

The BioAgora KENs feature real-world applications and test and demonstrate how the SSBD may support evidence-based biodiversity policymaking in the future. Two of these KENs, on Freshwater and NBS, were used to test different consultation approaches for scanning the horizon for research needs and prioritising them.

5.1 Methods

5.1.1 Freshwater Knowledge Exchange Network

Freshwater KEN is conducting a multi-step expert consultation and ranking exercise using a modified Delphi protocol with an online survey to identify key new research needed to support the EU Nature Restoration Law goal of restoring 25,000 km of free-flowing rivers by 2030. Respondents, including researchers, policymakers, and practitioners, listed up to three research topics, specified their spatial relevance, and provided demographic information. Half of the respondents were also asked to list up to three barriers to action for realising the goal. The survey underwent a pilot test at NINA, leading to refinements of the questions. The final survey was administered via SurveyMonkey (4–23 March 2024) through targeted emails collected from the Freshwater KEN, newsletters, and social media. The topic submissions were standardized, split into distinct entries, and consolidated into unique topics. These were categorized into 10 main themes and 27 subcategories based on occurrence frequency and thematic relevance. On 18 April 2024, at the Free Flow 2024 Conference in Groningen, The Netherlands, an expert workshop refined the research topics through interactive discussions on pressing research needs, interdisciplinary collaboration, and policy implementation barriers. Feedback was incorporated into further topic refinement. 27 key research topics were finalized and assigned spatial scales. A ranking survey was pilot tested in September 2024 at the Leibniz Institute of Freshwater Ecology and Inland Fisheries, revised, and distributed via SurveyMonkey (22 October–15 November 2024) to respondents from the first step and who indicated to be willing to do the ranking. Topics were ranked using five weighted measures: (1) average score (30%), (2) frequency in top 10 (25%), (3) first-place rankings (20%), (4) second-place rankings (15%), and (5) third-place rankings (10%).

Final rankings were generated by normalizing weighted scores, with lower values indicating higher priority.

In addition, in Task 3.1, we developed a prototype framework for extracting knowledge gaps from written documents along with other types of knowledge elements, i.e., textual segments (for method details, see D3.1). This was done by manually extracting gaps from the Biodiversity Strategy to 2020 evaluation report by the European Commission (2022), and two documents linked to the Freshwater KEN focused on restoring free-flowing rivers in Europe. These textual segments were collated to an Excel table along with relevant keywords, spatial scope, temporal scope, update frequency, reference, output, typology of information, as well as related pillars, actions, and other additional EU policies, and knowledge on whether the gap has already been filled. For the exact extraction process, see D3.1, Annex 2.

5.1.2 Nature-based solutions Knowledge Exchange Network

The Urban NBS KEN is testing the Delphi survey method to identify and prioritise practitioner-driven knowledge needs for developing ambitious "Urban Nature Plans," as referenced in Target 14 of the EU Biodiversity Strategy for 2030, focusing on five steps outlined in the EU guidance for cities preparing an Urban Greening Plan: defining long-term visions and goals, assessing the current state of nature and biodiversity, setting indicators and targets, identifying priorities and actions, and establishing a system for monitoring, reporting, and evaluation. The tested Delphi technique involves an iterative process of gathering expert judgments through multiple rounds of anonymous surveys, where participants receive feedback on previous responses to refine their insights (Beiderbeck et al., 2021). The NBS KEN exercise aims to assess the advantages and limitations of applying this method to non-science actors, a key group for fostering an all-inclusive SSBD.

The expert panel consisted of local planners and policymakers actively engaged in drafting urban plans focused on nature, greening, or biodiversity. These experts were identified through a preselection process of a large sample of plans based on NBS databases and partnerships within the KEN network. Invitations were sent to representatives of 32 urban plans, and 10 experts from the cities of Madrid, Amsterdam, Krakow, Lisbon, Bolzano, Malta, Glasgow, Bilbao, Lappeenranta, and Turku agreed to participate.

The first-round questionnaire gathered expert perspectives on the requirements for ambitious Urban Nature Plans and the extent to which existing plans align with EU guidance. It was structured into two sections. The first section included open-ended questions, allowing experts to share their broader insights into the selected guidance steps based on their experience in urban nature and biodiversity planning. The second section combined closed- and open-ended questions, where experts provided specific input on indicators, targets, interventions, and prioritisation criteria in existing plans, drawing from their direct involvement in plan development.

The first round of consultations was launched in June 2024. To accommodate participants' schedules during the summer, the first-round consultation remained open for two to three

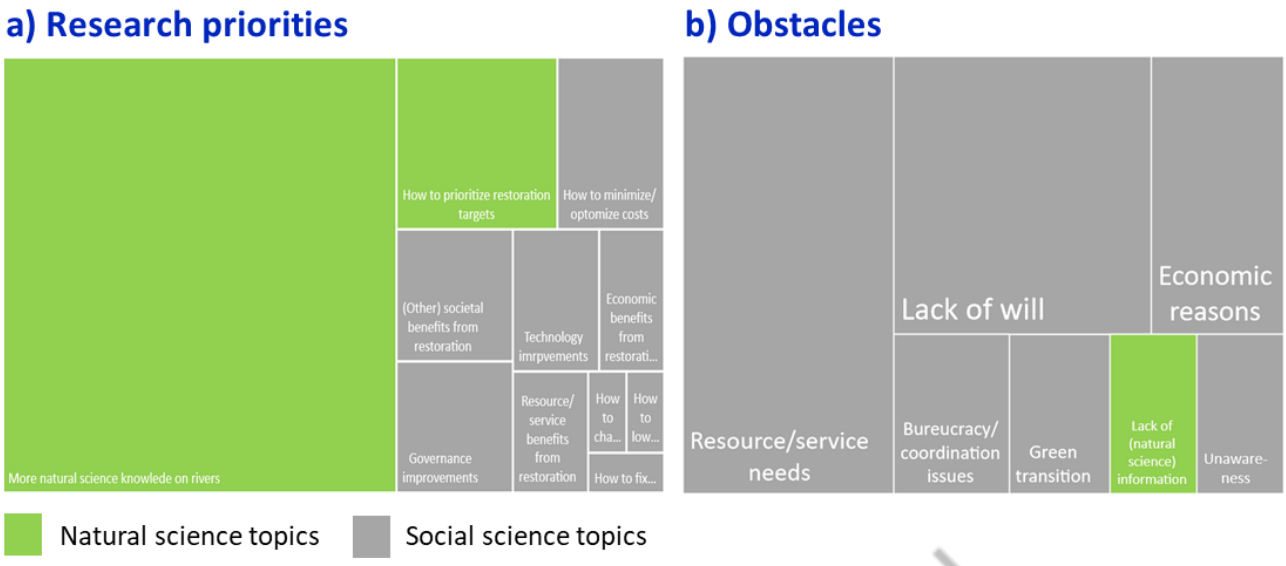
months. Responses were analysed using the qualitative analysis software MAXQDA to identify areas of consensus and divergence regarding Urban Nature Plan content. Experts also proposed additional targets and indicators beyond those included in the guidance. A summary of answers was then shared with the panel, alongside the second-round questionnaire.

Building on the first round, the second consultation focused on four key themes that emerged: biodiversity, ecosystem conditions, recreation and cultural ecosystem services, and climate adaptation. Additionally, it addressed five critical issues related to plan targets, priorities, actions, and coordination with other policy instruments. This consultation took place from December 2024 to January 2025, with nine out of 10 experts providing responses. At the submission time of this deliverable, the NBS KEN is analysing the second-round responses and preparing a follow-up engagement to share results and discuss their implications.

5.2 Results

5.2.1 Freshwater Knowledge Exchange Network

The first survey round yielded 237 responses with 647 topic submissions from 45 countries, predominantly from the EU, a total of 75 participants from 25 countries ranked their top 10 research priorities, and the expert workshop was attended by 18 participants from 13 countries. The preliminary results and experiences from the Delphi point showed that even though the participants had a wide range of job positions ranging from researchers to managers and policymakers, the vast majority had a natural science background by training (Fig. 1c), and potentially as a consequence, the identified research needs were also predominantly from the realm of natural sciences (Fig. 1a). However, most of the obstacles to river restoration were identified to be society related and only a small portion of the respondents named lack of natural sciences as a hindrance to river restoration (Fig. 1b). Further analyses are needed to explore whether asking the respondents to indicate barriers to action changed the types of research needs proposed.



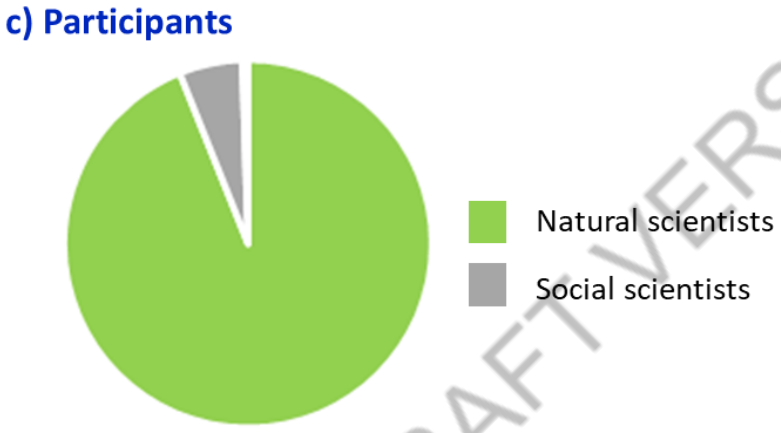


Fig. 1. *The relative proportions of proposed research priorities in natural and social sciences (a), the proposed obstacles to action (b), and the academic background of participants (c) in the Freshwater KEN Delphi.*

The results and experiences from extracting gaps from written documents are presented in more detail in D3.1, and resulted in successful knowledge gaps extraction. Extracted gaps may be collated into a database on knowledge gaps along with searchable keywords and other related data could function as a background for research prioritisation exercises. However, the number of detected research gaps was low, and manually extracting knowledge gaps from literature is highly labour-intensive, requiring a large amount of time resources. Because research gaps and particularly research priorities may change rapidly, literature may also not be the most efficient source for assessing up-to-date gaps because publishing peer-reviewed scientific results take time. If extracting gaps from literature, one should critically assess when the gaps were identified and what changes may have happened since.

5.2.2 Nature-based solutions Knowledge Exchange Networks

The preliminary results (assembling the expert panel and processing results for research priorities) and experiences from the Delphi survey highlight the following challenges:

- Identifying and contacting local planners was challenging due to incomplete or outdated information in NBS databases at the local level and municipal websites, hindering effective outreach and engagement.
- Despite including some consultancies in the expert panel, expanding participation beyond municipalities with established EU project collaborations was challenging. In some cases, KEN leads had to rely on personal networks to secure engagement, potentially introducing biases and limiting diversity. Additionally, existing commitments of municipalities to other research projects were considered a limiting factor in engaging local planners.
- Securing long-term expert engagement was difficult potentially due the time-intensive nature of the survey, and the lack of direct incentives. Despite efforts to keep the questionnaires concise, the multi-round process—requiring experts to review the summary of peers' input, reconsider their opinions, and answer new questionnaires—proved demanding. This led to frequent reminders and the withdrawal of one expert during the second consultation. Participants, especially non-academic experts, might prioritise other obligations over the survey due to the absence of tangible benefits/incentives.
- The questionnaires included open-ended questions to guide experts' reflections on limitations and barriers, rather than directly asking them to identify research needs. The latter were later identified based on the subjective interpretation of qualitative data.
- The Delphi survey results require further interpretation to establish research priorities, including distinguishing between knowledge needs in the scientific literature and practitioners' capacity limitations. This step is essential, as addressing research needs differs from strengthening practitioners' ability to apply existing knowledge.

6. Lessons learned

In this section, we summarize and discuss the lessons learned from the exercises presented in Chapters 2-5, i.e., mapping the network of actors, interviews with key actors, literature review, and testing the identification and prioritisation of research gaps in BioAgora's KENs. As many of these exercises independently pointed to same lessons learned, we have combined them under thematic headings 6.1-7.

6.1 The landscape of actors

The diverse array of fragmented actors and processes (Chapter 2) related to horizon scanning for knowledge needs and research prioritisation for biodiversity forms a complex and dynamic system where the risk of duplicating work is high, and stakeholders and actors can easily be burdened by

double-consultations and surveys or interaction fatigue (3.2.2-3). Biodiversa+ efforts, for example, are designed to align with and complement Horizon Europe calls, but they are separate from the prioritisation processes by EC (3.2.2-3), yet, it might be that people consulted by Biodiversa+ are partly the same as those consulted for Horizon calls by EC (3.2.3). Furthermore, as shown by the scoping process done in Chapter 2 and the interviews and interactions in Chapter 3, it is challenging to get a complete image of how different organizations conduct and participate in horizon scanning for research needs and prioritisation exercises, as these processes are rarely consistently reported and openly available, often (partly) confidential, and the number of exercises and consultations high. While many actors contribute to knowledge need mapping and prioritisation efforts, their roles, expectations, and capacities vary significantly, making orchestration complex when activating the network of actors. Some of the initiatives are also likely to operate temporarily because of short-term projects rather than long-term commitments, funding or mandates. This short-term project-based practice limits the ability to operate with a stable and fixed mechanism for collaboration and knowledge exchange. Without a stable and fixed mechanism, fragmentation and missing actors remain a risk. Interview with key actors (Chapter 3) revealed more stable and fixed mechanisms (albeit not all-inclusive and transparent), but are sensitive to internal re-organisations, downscaling priorities, mandates, tasks for these mechanisms and the difficulties to get consistent input from member states and relevant actors because of duplication or even triplication of surveys and involvement. Furthermore, it may be challenging to govern networks from outside and/or concentrate only on formal networks, while providing (informal) networks with capacities to coordinate themselves may provide more useful (3.2.3).

When considering reformations to the current landscape, it is crucial to notice that there have been attempts to review an EPBRS-type of structure, but these attempts have failed in the current landscape where EC and Biodiversa+ have largely taken over the former tasks of EPBRS. As countries are now consulted for Horizon calls directly through Programme Committees, they have not expressed interest in participating in a revived EPBRS (3.2.1). Furthermore, it would be challenging to integrate a new EPBRS-type of actor into the legal basis of the Horizon programme (3.2.2). Yet, it appears that the Programme Committees and Biodiversa+ have not recreated the strong science-policy community–creation and capacity building which was the major strength of EPBRS and which may have contributed to effective research prioritisation more profoundly than the actual research priority lists (3.2.1; Dey et al. 2020; Rudd 2011). Lack of such community-creation in the current landscape may hinder its ability to find the crucial research needs in a collaborative way.

Involving funding agencies and other clients into the designing phase of the exercise (i.e., co-creation) increases the legitimacy of the results of the exercise, making it more likely to be used (3.2.1). The results need to be delivered in the right format at the right time (3.2.1) and many scientific papers on mapping and prioritising needs fail to do this (Nesshöver et al. 2016).

6.2 Transparency and all-inclusiveness

The exercises of scanning the horizon for knowledge needs and research prioritisation found in literature often lack details on participants' numbers, selection, backgrounds, or ways of recruitment (Dey et al. 2020). This applies both to specific exercises, often published as academic papers, as well as to larger scale research agendas (Eggermont et al. 2021; European Commission 2023), and the former work of EPBRS (3.2.1). Processes on establishing research agendas may be partly or entirely unavailable to the public (3.2.3). This makes it challenging to assess whether these processes were inclusive, and how potential participant biases may have influenced the outcomes (3.2.3). Furthermore, while research agendas often refer to a high number of diverse inputs (i.e., policy documents and policy goals to research prioritisation exercises; European Commission 2023), they do not always specify how these sources were selected, integrated or weighted against each other. This in return results in possible subjective and unclear interpretation. Lack of transparency may also create opportunities for selective or distorted use of inputs, which may lead to outcomes that reflect vested interests rather than broad societal needs.

Transparency constraints may also mask the policy impact of the prioritisation exercises, making it unclear to what extent different exercises truly shape research agendas (see also 6.3 and Rudd 2011). For example, the uptake of EPBRS results into Horizon funding call was usually not formalized nor monitored, making it hard to assess objectively the effectiveness of this mechanism (3.2.1). It is also not openly disseminated which inputs EC uses for the formulation of the different Horizon calls (3.2.2-3). Particularly, with the lack of a clear client or requester (e.g., DG RTD, national research agencies), evaluating the impact of prioritisation exercises is challenging. It is unclear whether research papers motivate funding decisions because these papers rarely engage with financing bodies (Dey et al. 2020; Cooke et al. 2010, Sutherland et al. 2009).

Transparency in identifying and ranking research priorities is fundamental for fostering trust, inclusiveness, and accountability, particularly in the field of biodiversity conservation where transformative change is seen as a necessity for tackling the direct and indirect drivers of biodiversity loss (IPBES 2019). By openly sharing methods, criteria, and data, these prioritisation exercises can assist in demonstrating that policy decisions are evidence-based and reflect a broad range of perspectives. From the perspective of transformative change, transparency is especially critical because it helps to address systemic biases and imbalances in power. Openly documented processes allow diverse voices also from underrepresented groups and disciplines to be recognized and included. It is essential to break down entrenched hierarchies and foster equitable decision-making that aligns with long-term societal and environmental goals.

6.3 Politics of knowledge

Research prioritisation is inherently influenced by the politics of knowledge, reflecting the values, interests, and power dynamics of involved research communities, political organizations, industries, and policymakers. Research prioritisation exercises for biodiversity are often led by established research groups or conducted within well-recognized fields that already hold

significant positions in the science-policy interface. Attempts to broaden participation and open up to anyone often fail to balance the participation, as stronger and more established groups still tend to have more resources for participating and thus end up overrepresented (3.2.1-3). The influence of strong existing groups also influences what gaps are featured in existing literature and project deliverables, meaning that even if one attempted to consult "diverse" sources and map the needs by consultations and literature, the strong group bias is hardly solved (3.2.2).

Funding strategies such as the Horizon Europe Strategic Plan are steered from the outset by existing power politics and political goals embedded in broader strategies such as the European Green Deal or the Critical Raw Material Act (European Commission 2023; 3.2.2). Already the legal basis of the funding framework of the Horizon calls delineates the pillars and Clusters defining the outlines of the funded topics (3.2.2), i.e., the general outline of research to be funded is often determined well before a more systematic priority mapping (e.g., natural sciences may be a pre-selected focus rather than unintentional bias; see 6.4). The content of the eventual call texts can also be influenced by relative powers of different DGs, as well as lobbying and the ability of specific groups to advertise their gaps and priorities to the EC (3.2.2).

To bring together several primary prioritisation exercises and other background documents into descriptive research agendas, subjective interpretation is unavoidable, and the values, worldviews, and backgrounds may highly influence the interpretations. For instance, sustainability and biodiversity conservation can be approached through various viewpoints, such as green growth, degrowth, or earth stewardship (as described by IPBES 2022), angles which can each lead to very different research priorities even when using the same background documents.

To what extent the above-described influences might be problematic depends on whether they support or hamper prioritising research which would be most effective in supporting the democratically endorsed goals. Strong research groups and lobby groups might help voice important research needs on their specific fields and sectors, yet they may perpetuate existing power dynamics, funnelling resources toward already-dominant disciplines and problems which may reflect past funding trends and institutional priorities rather than current or future needs, while potentially putting less emphasis on emerging or interdisciplinary fields (Shapiro 2014). This may prove particularly problematic if the strong groups are predominantly those in natural sciences (6.4). Similarly, predefined political scopes may be effective in aligning strategies with topical biodiversity conservation and restoration efforts, yet one can also argue that they may limit the range of research topics considered and overlook innovative and unconventional approaches that fall outside the dominant narrative. Overall, politics of knowledge is inevitable in aligning research with societal goals, but it is crucial to critically assess and tackle the possibility of narrower interests distorting the image of what type of knowledge is needed for the wider interest of biodiversity conservation and restoration.

If the level of transparency and inclusivity is high, research prioritisation processes may have the potential to autoregulate themselves and prevent overrepresentation of strong groups, as any groups left out or disagreeing have a chance to have their voices heard, e.g., in open consultations

or by other commenting channels (3.2.3). This highlights the synergies between transparency and politics of knowledge.

6.4 Representation of research fields

Researchers are prone to report and disseminate knowledge needs in their own fields of expertise (Jucker et al. 2018) as they are often most aware of these needs and may experience them as most important due to familiarity with the topic. There may also be conscious or unconscious interest in attracting funding to their own field of research. Even when researchers are aware of the importance of other knowledge needs in different fields, it may be difficult for them to articulate these needs because of lack of expertise. Furthermore, amid the high competition for research funding, researchers are trained to argue how their field in particular, is best placed to solve scientific and societal problems, making them more familiar with creating narratives to promote their own research field rather than comparing the importance of their own field with other fields. Because of this it can be problematic when a certain field of science becomes disproportionately represented in knowledge needs and prioritisation exercises, as this may lead to a narrow disciplinary focus overlooking crucial needs across other disciplines.

In the case of biodiversity research, natural scientists, such as biologists, ecologists, and environmental scientists, often dominate prioritisation exercises (3.2.1; 5.2.1). While their expertise is essential for understanding biodiversity itself, this overrepresentation can undermine contributions from other fields that are equally essential for developing effective conservation policies (3.2.1; 3.2.7). An overemphasis on natural sciences risks framing biodiversity conservation primarily as an ecological challenge, neglecting the socioeconomic and political factors that drive biodiversity loss (see also D1.1 and D2.4, and 5.2.1). Disciplines such as economics, humanities, political science, anthropology, and sociology can offer vital insights into these dimensions (3.2.1). Bias towards natural sciences may therefore contribute to the severe mismatch between the most studied topics and those that hinder pro-biodiversity decision-making in real life (Dey et al. 2020; 3.2.1), and in addition between the expectations of policymakers and the suggested priority research (Nesshöver et al. 2016). Overrepresentation of any single discipline can also reinforce silos (i.e., within units, departments, disciplines), undermining the integrated and holistic approaches needed to include other relevant silos and drive transformative change (3.2.1).

IPBES partly tackles this challenge by separately addressing knowledge gaps and operationalization gaps, the latter referring to aspects limiting the operationalization of biodiversity knowledge into decision-making, such as lack of resources or capacities for conservation (IPBES 2022). However, they do not further elaborate which (interdisciplinary) knowledge could solve operationalization gaps.

While many studies document roles of diverse participants—such as researchers, managers, or policymakers—they rarely include information about the scientific disciplines in which participants were educated or have primarily worked in. This lack of details makes it difficult to evaluate to what extent existing exercises are dominated by natural sciences or whether other critical disciplines are adequately represented.

6.5 Aims and criteria for ranking research topics

Exercises of horizon scanning for knowledge needs and research prioritisation can serve different goals, from advancing a specific scientific field or solving biodiversity problems including small-scale prioritisation within research fields and broader research agendas of universities, networks, governments, and EU (Dey et al. 2020; 3.2.1). Thus, they can support decision-making both at highly local level and at large scales (Eggermont et al. 2021; European Commission 2023). Depending on the goal(s) of the exercise, highly varying criteria can be used for ranking the research gaps in priority order (Chapter 4). As the aim(s) of a prioritisation exercise defines which ranking criteria will be employed, as well as for which purposes the results can eventually be used, it is crucial to define clear aims when planning prioritisation exercises. This ensures that research efforts are effectively targeted and impactful.

In papers focused on biodiversity, the aim is often to identify gaps within a specific, pre-defined field of research (Nesshöver et al. 2016). These exercises aim to advance that particular research field or to determine which field specific research questions would best contribute to biodiversity protection and restoration within that domain. While these prioritisation exercises are valuable for researchers in the field in question, they should not be used as a tool to assess the overall importance of this field over another, as these studies rarely conduct cross-field comparisons and instead focus solely on the boundaries of the particular discipline. When the aim of the exercise is to address real-life biodiversity issues and/or create wider research agendas, a more inclusive and cross-sectoral approach is required. Interdisciplinary approach ensures that research agendas address the full complexity of biodiversity challenges and actually help solve them instead of advancing science fields where there is already sufficient knowledge to enable action.

Despite the importance of clear aim(s), they sometimes remain ambiguous. Many papers state they aim at mapping "important" research gaps without specifying from which angle the importance is to be assessed. It is challenging to determine what would be the expected impact on science and society if the suggested gaps were to be filled, because the participants may have contributed with research gaps having multiple and various aims and ranking criteria in mind. The lack of clarity means funding agencies and policymakers may not be able to properly use these prioritisation exercises to allocate resources and make strategic decisions. When large research agendas are designed with multiple goals in mind (e.g., advancing certain fields of research and solving certain biodiversity problems) it is important to do a reality check on whether the chosen methods can be expected to deliver to all aims.

When drafting large-scale research agendas, it is crucial to ask whether previous small-scope exercises may contribute to the goals of the research agenda in question. For example, the IPBES research gaps mentioned in the different assessments are often referred to as being important across various contexts. IPBES however defines that these research gaps are "pieces of knowledge, information or data that are absent or insufficient *to fulfil the mandate of the assessment*." For example, the IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia (IPBES 2018) aims at providing "a critical analysis of the state of knowledge regarding the importance, status, and trends of biodiversity and nature's

contributions to people". If acquiring an analysis of the state of knowledge is a policy priority, the gaps identified in the report can be considered prioritised research gaps. However, if the policy priority is instead to develop solutions for better biodiversity conservation, the gaps identified in this report may be less relevant for developing solutions.

6.6 Cognitive biases

Cognitive biases are systematic mental patterns that cause human judgement to deviate from rationality through subjective perception of reality, and they may have central implication for research prioritisation: For example, non-anonymous ranking, re-ranking after seeing the results from other participants (Aldridge et al. 2023; Skórka et al. 2021; Cuhls et al. 2022; Cuhls 2024), as well as face-to-face or online workshops may be seen as ways to increase consensus, enhance learning, and land on a common decision through deliberative processes, and as such a desirable and necessary part of research prioritisation, but approaches can also introduce biases through social pressure. Because people tend to agree with the group, workshops may overestimate the degree of consensus (also called the group think and bandwagon effect; Mukherjee et al. 2018; Winkler & Moser 2016) and top research priorities may receive a higher ranking than they would receive based on individual assessments. Furthermore, group opinions may be biased towards the opinions of individuals in higher social positions (also called the halo and dominance effect; Mukherjee et al. 2018).

Priming and anchoring effects (Winkler & Moser 2016) might skew research prioritisation for biodiversity by narrowing the scope of consideration to biology-centric fields. Words like "biodiversity" may prime stakeholders to focus exclusively on ecological or biological sciences, inadvertently sidelining disciplines (e.g., engineering, economics, social sciences), which may provide equally critical solutions to biodiversity conservation and restoration. Anchoring could further exacerbate this bias by focussing discussions only to a perceived core field, limiting creativity and cross-disciplinary integration that is essential for tackling the complex, systemic challenges around biodiversity. If participation is, in addition, biased towards natural scientists (6.4), participants may likely adhere to the paradigm of biodiversity research as a solution to biodiversity crisis (so called Semmelweis reflex and shared information bias; Mukherjee et al. 2018). It is known that relatively small changes in framing can change what people find important; e.g., simply changing the name of a collaborative game to a more competitive individual one can drastically change peoples' behaviours (Liberman et al 2004). One might thus expect that framing differences in different prioritisation methods (4.2) can have similar effects. Direct elicitation of knowledge needs for funding purposes, for example, may invite a more competitive mindset where participants strongly advocate the interests of their respective groups, while indirect methods, such as mapping future trends that may result into research needs, may invite a more neutral mindset.

6.7 Time and capacity constraints

Most challenges described above are often a result of time and capacity constraints rather than ignorance or intention. Actors conducting research needs and prioritisation exercises, particularly key actors such as EC and Biodiversa+, are aware of the shortcomings of selected methods and often have their own internal workplans for how to minimize them (3.2.2-3; see also Sarkki, et al. 2014), but may be driven towards the use of suboptimal methods under the pressure to deliver in short time frames (3.2.2). EPBRS, for example, aimed at the involvement of economists and policymakers to broaden participation and avoid the natural science bias, but economists and policymakers remained difficult to find and often left the processes (3.2.1), making it challenging to have transdisciplinary discussion.

During the interviews (3.2.2), DG ENV indicated they would find it useful to have more systematic mapping of priority knowledge needs especially in certain topical areas relevant to the EU Biodiversity Strategy for 2030. Unfortunately, this kind of mapping is sparsely done due to time and budget constraints (3.2.2). Participants are often restricted by available travel funding and travel distance to in-person workshops (3.2.1, 3.2.6). Some member states and regional organizations may not have the capacity to participate in prioritisation exercises because of the lack of time and/or available travelling budget (3.2.1-2). It is also clear that systematic, large prioritisation exercises, such as those by the former EPBRS, require secured core funding both to enable the functioning of the core organization as well as wide participation (3.2.1). As a result of current work pressures, scientists, policymakers and other relevant stakeholders face difficulties to make time reservations for in-depth, multi-day meetings and co-production which used to be the trademark of former EPBRS (3.2.1). For attracting capacities, it is crucial that the funding agencies and clients see their own interest in these exercises (3.2.1).

7. Recommendations

7.1 Tackling the challenges with the right methods

When selecting methods for scanning the horizon for knowledge needs and prioritising them (4.2) one needs to consider the aim of the exercise, time and capacities available, which can be done with the support of the decision tree (Fig. 2). In particular, it is crucial to decide whether the exercise will be based on the direct elicitation of knowledge needs or on knowledge needs resulting from future trends, threats, barriers and/or scenario analyses. When assessing the time resources required for different types of exercises, the MAGICKS App[1] developed by Eklipse may also provide useful.

[1] ksm-eklipse.shinyapps.io/MAGICKS/

Regardless of the chosen method, it is important to adapt it in a way that allows tackling and minimising the challenges identified in Chapter 6, including ensuring transparency, wide participation, clear aim setting, acknowledgement of the actor network, as well as the interdisciplinarity required for effective prioritisation (see Fig. 3). The policy of knowledge could potentially be minimized with an all-inclusive orchestration of the actor network where incentives are provided that favour the 'doing it together' rather than the 'acting alone'. In Table 5, we present various potential ways to adapt the methods to account for these challenges.

Table 5. *Recommendations to address the key challenges of methods for scanning the horizon for knowledge needs and prioritising them.*

Section	Challenge	How to minimize the challenge
6.2	Lack of transparency	Make methods used, data collected, communication flows, participating persons and final results open access to enable the exercise to be replicated and evaluated.
		Document and report the numbers of participants at each stage of the exercise (background and current position in percentages). Describe the method on recruitment and involvement, dissemination channels; criteria for ranking the research gaps and how it was presented to the participants and to the client.
		If any changes were made to the original submitted topics during the refining process and/or workshop(s), disclose the original topics, the changes and the reasoning behind them.
	Lack of inclusiveness	Involve a wide range of relevant participants, e.g., from researchers to policymakers, practitioners, businesses, and civil society, as well as a wide range of representation from different research fields, career stages and institutions.
6.3	Conflicting interests hampering the achievement of the aim of the exercise	Apply increasingly transparent approaches listed above; this will enable scrutinizing potential influence of conflicting interests.
		Select participating actors based on the aim of the exercise, rather than based on *ad hoc* decisions.
		Minimize inviting participants through personal connections; rather disseminate survey/expert invitations through dissemination channels of relevant actors using the 'Activating topical networks (i.e. KENs)' function of the SSBD.
		Find low-threshold participation opportunities (e.g., through short online surveys) and/or provide funding to allow for wider participation.
6.4	Natural science bias	Actively engage social scientists and other relevant disciplines.
		Rather than starting directly withmapping knowledge needs, include mapping of barriers and hinders which prevent solving the biodiversity crisis. Then proceed with interdisciplinary knowledge needs beyond natural sciences to address what research is needed to overcome the identified barriers.

		Report participating experts' research interests to increase transparency and allow for assessing the size of a potential bias.
6.5	Unclarity in aims and ranking criteria	Identify a clear target audience based on the aim of the exercise.
		Clarify what are the expected societal or scientific implications after the prioritised research has been conducted. For instance, specify whether the goal is to advance a pre-defined research field or solve a biodiversity challenge. Include details on the temporal and spatial scope of the exercise. Design the ranking criteria to align with the goal and scope.
		If using existing lists of knowledge gaps or other prioritisation exercises, ensure the aims of these exercises are aligning with the aims of the current exercise.
6.6	Cognitive biases	Enable participants to give anonymous feedback to avoid and identify group biases.
		Select low-effort methodologies while acknowledging their caveats.
6.7	Budget and time constraints	Find a target audience who have interest in knowledge need analyses and prioritisation exercises to raise engagement.

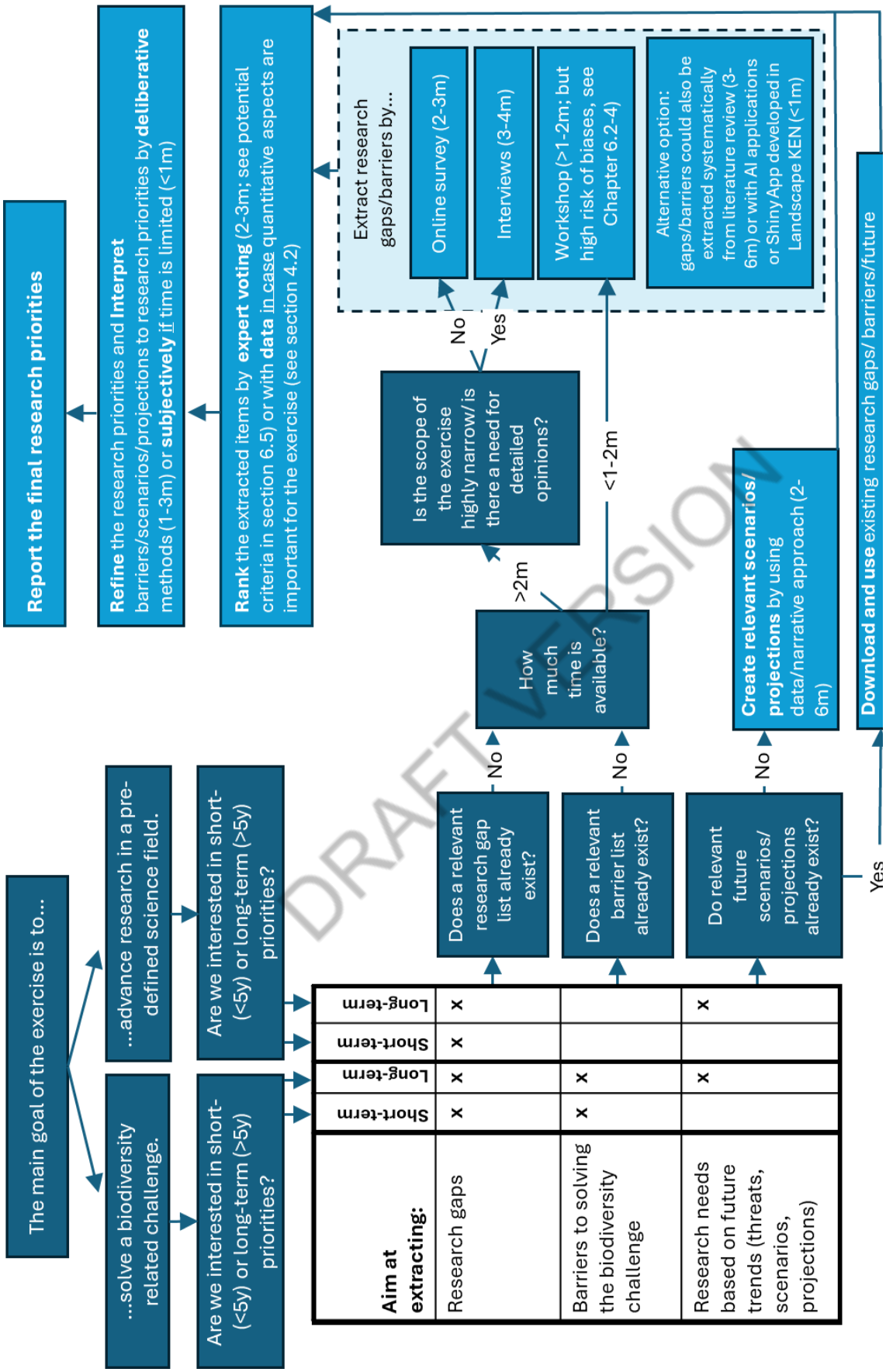


Fig. 2*. Decision tree on selecting items and methods for a research prioritisation exercise. The dark blue boxes represent the directive questions while the light blue represent actions. The numbers in brackets refer to expected time required in months.*

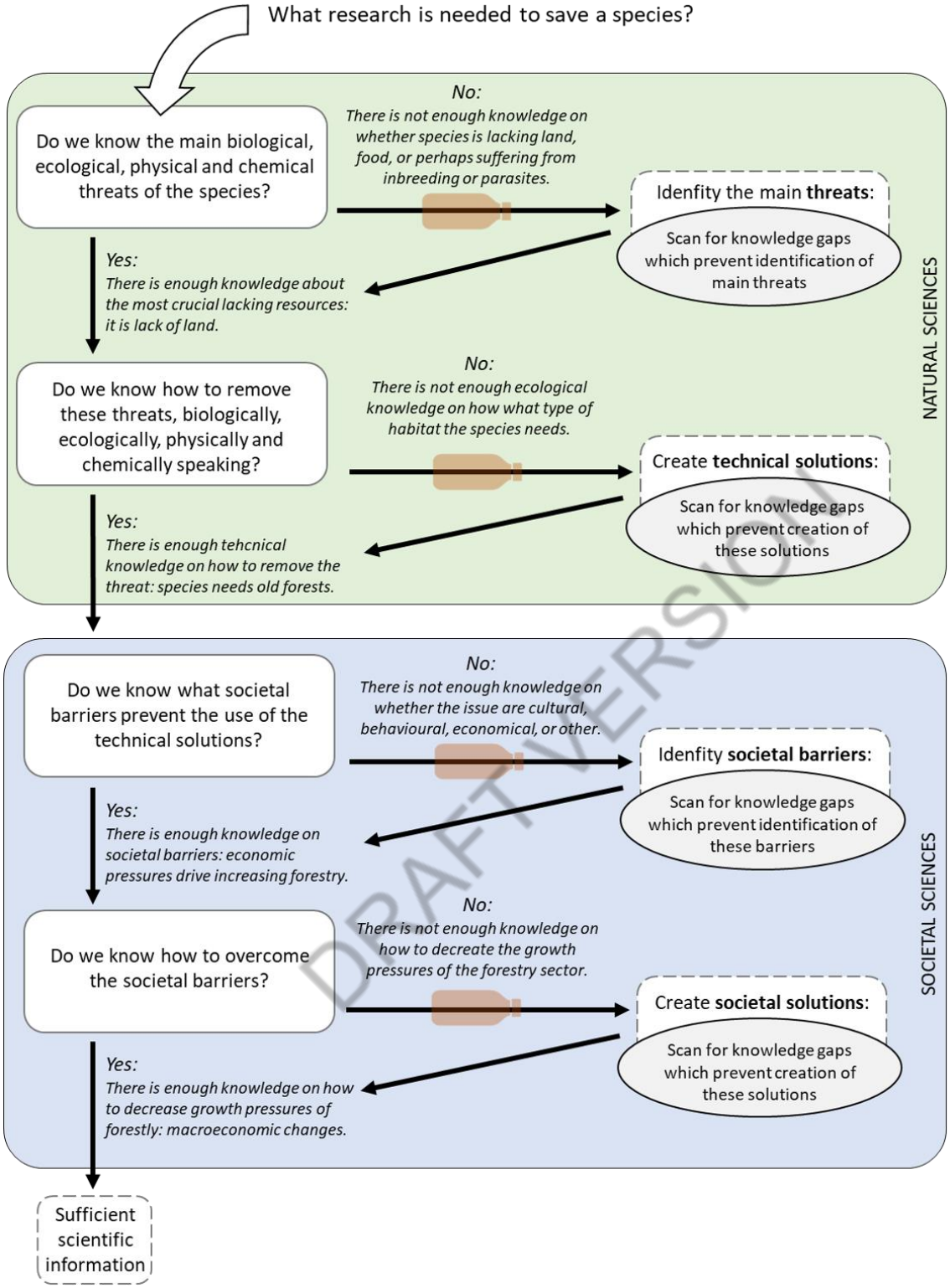


Fig 3. *A flowchart for establishing which knowledge bottlenecks are the most crucial to overcome to tackle the barriers to action, supporting holistic interdisciplinary research prioritisation. Once the baseline knowledge on natural sciences has been established, the returns on further natural science research may diminish in terms of biodiversity impact, and it may become increasingly valuable to focus more on societal research and transformative action.*

7.2 Scanning the horizon for knowledge needs and research prioritisation in BioAgora and the SSBD

In this section we provide specific advice for BioAgora and the SSBD on how to operationalize the lessons learned and recommendations by testing methods of horizon scanning for knowledge needs and research prioritisation for biodiversity in new KENs and responding to the requests from the EC, activities which will support developing the function for identifying and prioritising knowledge needs in the SSBD.

7.2.1 Testing methods in new KENs

KENs may follow the flow presented in Fig. 2 and Fig. 3 and the recommendations shown in Table 5 to decide the methodological details of their exercises. We however also encourage the KENs to explore any alternative ways to contribute, e.g., capacity building activity for actors involved in relevant processes. In particular, the Shiny App, web framework for developing web applications and currently developed in Task 1.3 Landscape KEN, may provide useful.

Yet, we advise KENs not to run exercises which scan the horizon for knowledge needs and/or prioritise them around a pre-decided research discipline. These exercises involve high risk of biases and amplification of existing power structures over effective and transformative research prioritisation (see sections 6.4-4). Instead, it may be useful to centre the exercises around a specific biodiversity challenge within KENs topic and identify and prioritise knowledge needs across disciplines by involving experts from multiple sectors and research fields (Fig. 3).

7.2.2 Responding to the requests from the EC

Due to the urgent nature of most requests and time resources needed for running systematic exercises of horizon scanning for knowledge needs and research prioritisation, potential knowledge gaps identified in answering the request are likely to be unsystematic and not solve the issues identified above. Time allowing, it may however be useful to look at the biases identified in Chapter 6 and think whether increased interdisciplinarity and/or transformative change approaches could be incorporated when describing the gaps.

On the other hand, some requests may specifically aim at mapping knowledge needs and allow for a more systematic prioritisation exercises, as in the case of the expected request assisting in the creation of the Long-Term Biodiversity Research Agenda. In these cases, we recommend using the decision tree presented in Fig. 2 and recommendations of Table 5 to co-design and co-develop these exercise together with the relevant actors of the landscape (see Chapter 2) in a way that addresses the challenges identified in Chapter 6. For topic-specific exercises it is crucial to start by identifying the specific papers, research groups, institutions and projects which may have already contributed to such before.

7.2.3 Developing the function for SSBD

In practice, the function for horizon scanning for knowledge needs and research prioritisation for biodiversity could take many forms in the SSBD governance, including but not limited to:

1. Identifying gaps non-systematically as a part of each request,
2. Identifying gaps non-systematically as as part of what comes forward from the work in sub-groups of the EUBP.
3. Scanning the horizon for knowledge needs and prioritising them systematically as a response to requests which specifically ask for this.
4. Scanning the horizon for knowledge needs and prioritising them at regular intervals within SSBD, for example yearly by the planned Mission Circle of SSBD, involving relevant topical network expert groups, either systematically (Delphi process or similar) or less systematically (one-time workshops).
5. Feeding the identified research priorities to EC through EUBP.
6. Supporting and transforming already existing processes of Biodiversa+ and/or the Programme Committees for Horizon calls.

When deciding on which format(s) to adopt, it is important to start by determining the purpose of the SSBD research prioritisation: Is it aiming at mapping research gaps for each requester, broader knowledge needs for Horizon calls, or perhaps to guide SSBD's internal work and anticipate requests? Furthermore, it is vital that the function minimises the challenges identified in Chapter 6 (see 7.1 how this can be done in practice).

If the function is to enhance orchestration and long-term collaboration with key actors, it is important to integrate it to the Programme Committees for Horizon Europe, the workplan of Biodiversa+, IPBES, and Eklipse, which would require transparency, trust-building and time resources from all actors, as developing a stand-alone and potentially highly overlapping structure is counterproductive. Such orchestration can be achieved if the SSBD realises a well-functioning Biodiversity Knowledge Agora, a meta network of KENs and other actors that can be activated selectively for specific target groups and for specific purposes. Overall, it is important to acknowledge that the SSBD could potentially be contributing to the wide variety of prioritisation initiatives, and therefore the orchestration function (building and activating the Biodiversity Knowledge Agora) is of utmost importance.

Mechanisms should be strengthened by establishing a structured Biodiversity Knowledge Agora platform that facilitates regular interactions, addresses consultation fatigue through targeted engagement and enhances effective, inclusive participation avoiding duplication. The different SSBD's organizational structures (see the upcoming governance model D4.1, due in June 2025) and SSBD key partners (e.g., DG ENV, DG Research, Biodversa+) will have to create a culture of participation, agree on a transparent process and enable joint decision-making. This would then secure the necessary transformative change approach for the function identifying and prioritising knowledge needs as outlined in this deliverable. KENs need to get an opportunity to be involved in the operationalisation of the function.

Exercises aimed at scanning the horizon for knowledge needs and prioritising them are mostly funded by funding agencies using the results for drafting research agendas. Securing their interest is critical for ensuring the continuity of the SSBD function. The costs and needed infrastructure vary highly depending on the type of activity, ranging from online surveys to deliberative workshops. Thus, the decisions on the type of activities are essential to clarify funding needs and requirements for the online SSBD platform.

In the long-term, the SSBD should aspire to incorporate the ethical infrastructure developed in BioAgora. So far, the exercises run by the two KENs have been highly topic-specific, associated to their respective research interests, which involves a risk for amplifying existing power structures and maintaining the already-strong research fields, rather than fostering transformative change that focusses on fairness, openness and inclusivity.

Furthermore, it is crucial to decide whether the SSBD will conduct horizon scanning and foresight exercises only for the purposes of mapping and prioritising knowledge needs, or whether it is expected to utilize these methods also for other purposes, such as alerting policymakers about future threats and trends (see e.g., Veenhoff et al. 2025), by, e.g., bringing them up in future SSBD policy dialogues. While some EC representatives have emphasized the former need, others have suggested that the horizon scanning and foresight for threats and trends would be more useful as a SSBD function.

In conclusion, we note that several actors, including IPBES, DG RTD (3.2.2) and Biodiversa+ (3.2.3), have recently developed or are in the process of developing their own guidance documents for conducting exercises of horizon scanning for knowledge needs and research prioritisation. Alignment with BioAgora Task 3.2, which is mapping factors that enable and hinder the impacts of Horizon research projects on policy processes, could also provide useful directions for shaping the role of research prioritisation in SSBD.

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Annexes

Annex I: Eklipse methods

Supplementary Table 1. Findings from the Eklipse reports regarding their description on how research gaps and research prioritisation exercises have been done for the different requests.

Report name	Publication year	Keywords used	Description on method(s) used	Type of method(s)
1. State of knowledge regarding the potential of macroalgae cultivation in providing climate-related and other ecosystem services	2022	knowledge gaps	"The scoping review was carried out to summarise the current state of the knowledge and identify potential constraints and knowledge gaps. For this purpose, **documents** were **screened** in three different steps (identification, screening, eligibility)."	Scoping Review
			"Knowledge gaps identified during the first round and ranked during the second round of the **Delphi process**."	Delphi Process
2. Types and characteristics of urban and peri-urban blue spaces having an impact on human mental health and wellbeing: a systematic review	2020	knowledge gaps, research gaps	"There is, thus, both a practical and theoretical need to gain a better understanding of which types and characteristics of blue space matter most for urban residents in terms of mental health and wellbeing. The objective of the present **systematic review** was to address this **knowledge gap**. This review aims to inform and provide recommendations to decision makers in several domains, such as health promotion, nature management, spatial policy, and urban planning and design."	Systematic Review
			"As each blue space may facilitate a unique set of restorative activities and experiences, a second **research gap** that requires additional attention is an increase in variety of blue spaces to be researched. As especially the **qualitative** outcomes indicated that there might be large variety in how individuals experience blue spaces..."	Qualitative Research
3. Types and characteristics of urban and peri-urban green spaces having an impact on human mental health and wellbeing: a systematic review	2020	knowledge gaps	"There is both a practical and a theoretical need to gain a better understanding of which types and characteristics of green space matter most for urbanites in terms of mental health and wellbeing. The objective of the present **systematic review** was to tackle this **knowledge gap**."	Systematic Literature Review
4. State of knowledge regarding how we can improve adherence to the Mitigation Hierarchy, with a particular focus on the avoid stage	2023	knowledge gaps	"An **Applied Policy Delphi process** supplemented the literature to address **knowledge gaps** and produce a report based on the best available evidence that also acknowledges where differing views occur to give an unbiased perspective."	Delphi Process

			"The **systematic mapping** provided an overview of the distribution and amount of evidence that existed related to the objectives of the request. It helped to identify **knowledge gaps** in the literature for which further information was sought from the expert consultation process."	Systematic Mapping
			"A **narrative synthesis** describing the evidence base was produced. A primary output was the collation of a catalogue of cases where mitigation hierarchy had been used in practice. Various **data visualisations**, such as bubble maps, were used to illustrate the extent of the evidence related to the study objectives and **knowledge gaps** that exist."	Narrative Synthesis, Data Visualisation
5. Biodiversity and pandemics: Interdisciplinary research and action priorities.	2023	knowledge gaps, research gaps, knowledge needs	"We highlight the areas in need of action with a relationship **matrix** between the policy recommendations and the **knowledge gaps** from the included articles of the **scoping review**..."	Scoping Review (literature-based method), Relationship Matrix, Scoring System
			"We synthesised the extracted data by different themes to derive policy recommendations and to identify **knowledge gaps**. First, we analysed the **term frequency** (see keywords for the **scoping review** in Annex 1), using **text mining** in **R "tm" version 0.7-11**. The policy recommendations were then **categorised and ranked based on term frequency**, and a corresponding recommendation was synthesised from the extracted data. The same process was followed for the **knowledge gaps** by **quantifying the number of articles addressing each specific topic**. This process resulted in a list of policy recommendations and **research gaps**, which was used for the development of **survey questions** in the **people-based methods**.	Text Mining (Term Frequency Analysis), Scoping Review, Quantitative Article Analysis, Survey-Based Validation
			"The **focus group discussion** was structured in five sessions. The third session (25 minutes) focused on the list of **Research gaps**, requesting participants to comment on the definition of items in the list and suggest possible additions. The final outputs of the **people-based method process** are the prioritised lists of **research gaps** in knowledge and policy recommendations, synthesised and commented on by the Expert Working Group."	Structured (Interdisciplinary) Focus Group Discussion, Expert Consultation, Facilitated Research Prioritisation Exercise, People-Based Methods (Facilitated Expert Discussion)
			"An online cross-sectoral **workshop** was co-organised in May 2021 by Eklipse and the European Commission - Knowledge Centre for Biodiversity (EC-KCBD) to **explore the needs** related to Biodiversity and pandemics and to **identify highly policy-relevant topics**...During	Expert workshop, Cross-Sectoral Consultation, Knowledge Needs Prioritisation

			the workshop, seven policy- relevant **knowledge needs** (hereafter referred to as "Requests") were identified..."	
			"A scoping group composed of members of the **Eklipse Knowledge Coordination Body, Methods Expert Group, and Eklipse Management Body** was created. This group proceeded to conduct a **literature screening and a Call for Knowledge** to gather relevant knowledge and searched for relevant existing or planned initiatives. An **online Focus Group** was also organised to narrow down the request...This focus group led to the creation of a cross-sectoral consortium of requesters working with the European Commission's Directorate-General for Research and Innovation (EC-DG RTD), co-developing the **knowledge needs** and expecting a **knowledge synthesis**."	Literature Screening, Call for Knowledge (Expert Consultation), Focus Group Discussion, Research Gap Synthesis
6. Building Resilient Coastal Communities through Nature-based Solutions and Empowerment Tools	2024	knowledge gaps, research needs	"The **EWG developed a draft methodological protocol** based on the **DoW**, describing the current **knowledge gaps** and **research needs** on the topic, and proposed the best methods of **knowledge synthesis** to address this request. An **open call for peer review** of the **methods protocol** took place and received feedback from **6 reviewers**."	Expert Consultation, Call for Expertise, Development of Methodological Protocol, Peer Review of Research Gaps
7. EU renewable energy policies, global biodiversity, and the UN SDGs	2019	knowledge gaps	"...the invited specialists were divided into **three breakout groups** of six people each... to cover **gaps** in experience and enhance **cross-fertilisation of knowledge** and ideas...Each group **brainstormed** using the previously developed **graphical models** and discussed the potential impacts of different **RES** and their extent. Various **guiding questions** were used to trigger discussions such as... **what is already documented**, **potential unforeseen or less known aspects**... **knowledge gaps**."	Expert Workshop, Facilitated Brainstorming, Group Discussion, Stakeholder Consultation
			"Through this **interdisciplinary exercise**, participants of Group C addressed biofuel production impacts, noting that their **models did not explicitly consider the level of uncertainty**. They focused mainly on biofuel impacts in developing countries... Additionally, based on **work they were involved in, participants detected potential side effects, including current knowledge gaps**."	Interdisciplinary Expert Discussion, Scenario-Based Assessment, Comparative Policy Analysis
8. What needs to be done to better integrate research and knowledge on biodiversity and ecosystem services from the global to the European level, and vice versa?	2019	knowledge gaps, knowledge needs	"Using the **knowledge gaps** and **methodological requirements** (e.g., for **scenario development**) identified by the **IPBES** to fill knowledge gaps through transnational actions. Other outputs of **BiodivERsA** include its **database** (on research projects, programmes, and funding across Europe), **mapping the research landscape, promoting stakeholder engagement, knowledge brokerage, and transfer**."	IPBES Research Gap Assessment, Research Landscape Mapping, Stakeholder Engagement, Knowledge Brokerage
			"**Identification of gaps** in knowledge, information, and data in the **IPBES work programme** and in completed assessments.	

			Consultations on these gaps and formulation of **priority areas for knowledge generation** with the scientific community. **Promoting the generation of knowledge** by tailoring these **priority research areas** to potential research funding institutions, mainly by means of **bilateral meetings with these funding organisations**."	
			"**Funders could help setting up such dialogue early on in the process. This could be done in a first instance when finalizing calls for research funding by inviting scientists and policy makers to jointly identify specific issues and knowledge gaps.** A further opportunity would be to facilitate the involvement of **key policy makers** during the **kick-off phase** of the research projects, so that they can better integrate **policy needs when formulating research questions and methodologies**."	Policy-Research Dialogue, Stakeholder Engagement, Funders-Researchers Consultation, Research Prioritisation Workshops
			"**Extraction of all formulations** indicating **direct or indirect research needs** originating from **CBD decisions**, resulting in **29 tables on specific issues**, which allows the user to check research needs under a certain CBD topic."	Text Extraction from Policy Documents, Thematic Categorization, CBD Decision Analysis
9. The diverse values of nature and integrating them into decision-making	2018	knowledge needs	"**We aimed to do this by inviting expert panelists who represented different aspects of the topic and by opening the conversation to the wider public and society**, making it possible for anyone to voice their thoughts on the values of nature. The dialogue would not provide a general conclusion or 'right' answers to the request but would rather give ideas on **how to deepen the research on the topic and perhaps see where gaps and further knowledge needs for scientific approaches exist from society's perspective**."	Stakeholder Engagement, Expert Panel Discussions, Public Consultation
			"**The discussion for this event was specifically planned around the knowledge needs expressed in the request.** Ideas about including **the general public in knowledge creation and dissemination were discussed.**"	Science-Policy Café, Stakeholder Engagement, Public Consultation
10. An impact evaluation framework to support planning and evaluation of nature-based solutions projects	2017	knowledge gaps	"**Here some of the major gaps and directions stemming from this quick scoping review of the literature are presented.** The list of knowledge gaps in Table 26 is designed to guide future research and practice..."	Scoping Review (Literature-Based)
			"**To make recommendations to improve the assessment** of the effectiveness of NBS projects, including the identification of **knowledge gaps** according to the **criteria presented in the impact evaluation framework.**"	Impact Evaluation Framework, Performace Criteria Assessment
			"The guide starts with recommendations on how to select and apply NBS indicators and methods. It then provides a **roadmap for the assessment of NBS impacts** across the 10	Scoping Review (Literature-Based Method),

			climate resilience challenges, with a focus on the **key knowledge gaps**, and future directions for NBS research and practice.... largely based on the findings of the **short scoping review of the literature** presented in the earlier sections of this report."	Roadmap Development
11. What do we currently know about the impacts of pesticide and fertiliser use in farmland on the effectiveness of adjacent pollinator conservation measures such as flower strips and hedgerows, and what additional research is needed?	2020	knowledge gaps, research gaps, research needs	"**EKLIPSE received a request by Pollinis on the 30th of June 2018, to produce an overview of the current knowledge and research gaps related to the impacts of pesticide and fertilizer use in farmland on the effectiveness of adjacent pollinator conservation measures.** The call was answered through a **Joint Fact Finding approach, including a workshop**, on the 9-10th Jan, 2020 at the Helmholtz Association, Brussels."	Join Fact Finding, Expert Workshop
			"One of the major roles of EKLIPSE is to identify and prioritise **research needs** through responding to knowledge requests from policy makers, civil society and the scientific community.... The process usually involves **evidence synthesis, prioritisation of research needs, and societal engagement activities** among others."	Evidence Synthesis (Systematic Review), Research Prioritisation (Policy Oriented), Societal Engagement (Workshops, Public Consultation, Co-creation Process, Participatory Research Prioritisation, Group Work)
			"Our process used the same type of **multi-stakeholder committee** and the same principle of focusing on available data and information to mitigate conflict, but the ultimate objective was to jointly identify **research needs** and priorities (stage 1 in JFF) .... We call this truncated process **"Joint Research Priority Finding (JRPF)""**	Multi-Stakeholder Consultation, Evidence-Based Prioritisation, Conflict Mitigation through Data Review, Joint Research Priority Findingg (JRPF), Joint Fact Finding (JFF)
			Group 3: Understanding the level of implementation of Best Management Practices (BMPs) among European farmers **(research need):** This can be assessed by a **quantitative survey** having a checklist on which best management practices are practiced...This could be achieved through **semi-structured interviews** of key stakeholders to achieve rich **qualitative data** and understand the barriers and bottlenecks of implementation"	Survey-Based Quantitative Assessment, Semi-Structured Interviews, Qualitative Research
			"The participants were asked to score the **knowledge gaps** (n=34) **based on three**	Scoring System (Quantitative

			criteria (feasibility, cost-benefit, relevance to policy) on a scale of 1 – 4 (1= low, 4= very high). The results show a **matrix of knowledge needs/priorities** depending on the chosen criteria."	Prioritisation), Knowledge Needs Matrix, Multi-Criteria Decision Analysis (Structured Decision-Making)
			"The focus was on the identification of the **knowledge gaps and emergent cross-cutting issues** rather than on assessing the quality of the evidence."	Expert Discussion, Thematic Analysis of Cross-Cutting Issues
			"Participants were asked to **work in pairs** and **look at two papers** in each pair to **identify** if there were any additional **knowledge gaps** or key findings...The **knowledge gaps** were **reformulated**, **merged** or **new ones added** based on the **brainstorming** within the group."	Pair-Based Literature Review, Structured Group Discussion, Thematic Categorization, Brainstorming,
			"They were invited to choose a **knowledge need** as identified during the morning and build a '**research action' tree**."	Structured Research Mapping (Research Action Trees), Visual Prioritisation
12. What is hampering current restoration effectiveness?	2019	knowledge gaps, knowledge needs	"In this study, we used the **Delphi technique** to identify an understanding of what effective ecosystem restoration is, and create lists of key components, barriers and **knowledge gaps** to achieve more effective restoration....The **survey** began with a set of **open-ended questions**, developed by the EWG, to extract participants' opinions on components of and barriers for EER, and **knowledge gaps** for the application of EER. We analysed participants' responses using **inductive qualitative analysis**. Due to the large amount of information obtained, we used **Atlas.ti® software** to analyse barriers for EER and **knowledge gaps**."	Delphi Process (Iterative Expert Consultation, Consensus-Based Prioritisation), Expert Online Survey (See Appendix 8), Inductive Qualitative Analysis, Thematic Coding (Atlas.ti Software)
			"Both the **scoping review** and the **Delphi process** imply that **knowledge gaps** are hampering restoration across a number of sectors."	Scoping Review (Literature-Based Analysis), Delphi Process (Expert Consultation), See Appendix 4
			Experts **surveyed** in the first round of the **Delphi process** also identified what hinders the exchange of knowledge in the restoration community and the additional **knowledge needed** to achieve a more effective restoration... Experts identified many items, which were **analysed and categorized by the EWG** using an **inductive qualitative analysis**.	Delphie Process (Expert Survey), Inductive Qualitative Analysis, Thematic Categorization by Eklipse Working Group (EWG)

Annex II: Interview questions

EPBRS

The background sections presented below in italics were recapped by the interviewer(s) before posing the questions.

Your background:

1. What was your role in EPBRS?
2. From when to when did you carry out this role?
3. After your function/role was finished, did you stay involved in EPBRS? As?

Structure of former EPBRS:

Membership in the EPBRS was open to all member and associated member states that participate in the 6th FP (2002-2006), the 7th FP (2007-2013) and the Horizon 2020 (2014-2020) Framework Programme and to the EU institutions. The participants to the EPBRS were nominated by their respective national representatives on the "Programme Committee" of the successive "EU Framework Programmes for Research and Innovation". The participating states were each asked to nominate one scientist (natural or social sciences) and one policymaker to attend the meetings and support the identification of thematic experts for them.

4. How were the national representatives decided, and how did they choose the scientist and the policymaker?
5. How were thematic experts chosen?
6. Were there any issues of subjectivity in these decisions, or how was subjectivity in these decisions minimized or even eliminated?
7. Should the equivalent participants in a future Science Service kind of EPBRS be chosen differently, i.e., based on more objective criteria or through more democratic process?
8. What did it imply that "membership in the EPBRS was open to the EU institutions"? Which institutions, who decided which EU institutes were relevant, how was the relationship between EPBRS and those institutes, how were the relationships between the different EU institutes when participating in EPBRS, and how did these EU institutes participate?

Functionality:

EPBRS was a forum at which natural and social scientists, policymakers and other stakeholders identified the structure and focus of strategically important research that is essential to use the components of biodiversity in a sustainable way, to maintain ecosystem functions that provide goods and services, to conserve, protect and restore the natural world, and to halt biodiversity loss. EPBRS: identified policies for which biodiversity and ecosystem services knowledge is important; reviewed the knowledge base and identified gaps that limit the effectiveness of policy; established

priorities for biodiversity and ecosystem services research to reduce these gaps; AND produced recommendations designed to support the Commission, Council and Parliament and the EU Member States in orienting research on the conservation and sustainable use of biodiversity and the equitable sharing of its benefits. By doing so, it aimed to provide advice on research for the European delegations to the CBD and other biodiversity related conventions, the Council Working Party on International Environmental Issues (Biodiversity), the European Commission and its agencies, and other relevant institutions and organisations.

9. How were the relevant policies identified?
10. How were the knowledge base reviewed and gaps identified?
11. How were the priorities established? How were the recommendations produced?
12. Where there any horizon scanning activities involved, i.e., scanning for future threats, not just currently existing knowledge gaps?

Connections to other organizations:

The EPBRS kept close connections with relevant international bodies, national governments and research organisations, EU institutions and EU projects in the field of biodiversity research. The strength of the EPBRS lied both in the associated national platforms and in its members, among whom are several who had participated in the multi-stakeholder meetings to prepare the IPBES, and national delegates to SBSTTA. Although the EPBRS had a regional remit, its research recommendations typically had much larger geographic scope and informed the work of IPBES on the global scale.

EPBRS supported the establishment of national platforms in all the countries that participated in its activities, to help inform the debates within the EPBRS and to promulgate the results of the debates to relevant stakeholders.

13. How did these connections work (meetings, result communication…)?
14. How did the “National platforms” function?
15. Which direction information of knowledge gaps was flowing, and how?

Budgeting:

EPBRS meetings were held under successive Presidencies of the EU, and some of the costs of the meetings were met by the host organisations. Otherwise EPBRS received no funds and depended on own funding of participants and joint activities with EU projects and other partners.

16. What were the “host organizations”? How did they step up saying that they would like to be a ‘host organization’?
17. Funding of participants = participants’ work hours covered by their affiliated institutions?
18. What were the “joint activities”?

19. How was the EPBRS secretariat funded and how much were these yearly costs (estimate)? How many persons (fte) did the secretariat have?
20. Is there any overview of how much was covered by each source?
21. Is there anything you would do otherwise if you were to plan funding for a similar initiative, anything the future SSBD could benefit from?

Other:

22. Are there any aspects important for the functionality of EPBRS that we did not cover in this interview?
23. Are there any general or specific obstacles or lessons learned? These could be useful for building the future EPBRS within the SSBD, to avoid potential past mistakes and to foresee challenges.
24. Are there any modification done during the course of EPBRS due to arising issues?
25. If you were to run EPBRS again, what would you do differently?

Advise for the future SSBD:

The SSBD is a platform funded by the European Commission which is currently being developed to support the Biodiversity Strategy 2030. Its aim will be to connect policymakers with providers of biodiversity knowledge and data in order to provide ad hoc and timely evidence-based support for policymaking on biodiversity. The SSBD will redirect requests for scientific evidence by the European Commission to the organizations and individuals who have the relevant expertise. The exact structure and functioning of the SSBD is still to be developed, and we would like to hear your opinion about your expectations and insights for theSSBD.

26. How do you perceive the current state of integration and weight of the knowledge on the drivers of biodiversity loss and on potential solutions into the EU policymaking process?
27. How do you think biodiversity knowledge should be better integrated at the EU level of policymaking?
28. What type of knowledge is missing and/or isn't enough taken into account through the EU policymaking process?
29. How can SSBD help design better policies or strengthen their implementation? Through which functions?
30. What kind of actors should participate in the SSBD to be effective and inclusive?
31. There is a lot of talking about ‘setting the European research Agenda’, ‘The long-term biodiversity research agenda’ while we have different independent and parallel initiatives at the EU Comm level, Biodiversa+ etc. What would you recommend we should do with this rather messy landscape?
32. How do you imagine the SSBD can be governed? How should be decided its work priorities?

EC

1. Is your DG directly or indirectly involved in the creation of "The Horizon Europe Strategic Plan 2025-2027 Analysis report", and how?
2. How is the Cluster 6 created, and particularly, what is your DGs role in it?
3. Do DGs consult other actors in this process? EUBP for example has been consulted by DG ENV. Are any other actors involved, such as Biodiversa+, European Research Executive Agency (REA), Joint Research Centre, IPBES or Foresight on Demand -project? Who are the consulted "experts" and how they are chosen, is there any overview on this?
4. The co-creation group work for Creation of Cluster 6 is a formal process - How much flexibility is there with regards to changing the processes?
5. Is your DG participating in the creation of the Long-Term Biodiversity Research Agenda? If so, how? How open is the agenda setting for The Long-Term Biodiversity Research Agenda? Would the Commission be open to hear method recommendations on methods or gaps?
6. Do you yourself think there is something that could be improved in the above-discussed processes, perhaps something SSBD could contribute to fixing? Has there been any specific or general lessons learned from the current or previous processes around this Cluster, for example past mistakes to avoid or methods for success – something that SSBD should learn from? Is there some training or other capacity building your DG would find useful for BioAgora to organize around research prioritisation?
7. Do you think it would it make sense to review EPBRS?
8. Were you involved into taking up EPBRS recommendations in the Horizon call process, and if so, how did that process look from your perspective?

Eklipse

1. How are the Eklipse call texts formulated, are they based e.g. on existing research priorities?
2. Eklipse selects which requests are answered based on criteria in Guidance Note 7a on Selecting requests. First Eklipse Management Body (EMB) assesses criteria A and B (pre-screening), then Strategic Advisory Board (SAB) assesses the strategic policy relevance and finally Eklipse Knowledge Coordination Body (KCB) makes the final decisions. How does this process go in practice?
3. How are the people in EMB, SAB and KCB selected?
4. Were there any issues of subjectivity in these decisions, or how was subjectivity in these decisions minimized or eliminated?

5. What proportion of the requests go through?
6. Has there only been this one Horizon scanning request going through, “Impacts of ElectroMagnetic Radiation (EMR) on wildlife.”?
7. Are there any requests where future threats would have been scanned?
8. What methods are used in research prioritising/gap identification for in Eklipse reports?
9. Does Eklipse in any way further the filling of the gaps/needs that it identified? (after the report is out)
10. How is Eklipse and the requests funded?
11. Are there any aspects important for research prioritising and horizon scanning around Eklipse that we did not cover in this interview?
12. Can you see any links how Eklipse research prioritising could be linked to research prioritising in SSBD in the future?
13. Any lesson learned from Eklipse that SSBD could use for its research need/gaps identification functions?

Biodiversa+

1. What are the links between research prioritisation for SRIA and the Flagship Programmes of Biodiversa+, and research prioritisation for Horizon calls by EC?
2. Are you interacting with country representatives for Horizon calls (the Programme Committees), or is this work done by EC and separate from Biodiversa+ General Assembly and other Biodiversa+ consultations? (In other words, to what extent has Biodiversa+ taken over the task of EPBRS?)
3. Biodiversa+ SRIA (Strategic Research & Innovation Agenda) refers to several (systematic) mapping and foresight exercises which were used in writing it (a literature study, consultations), yet it does not specify the exact methodologies used. Also, there does not seem to be information on how exactly the feedback from Partnership members, the Partnership Advisory Board, the EC and relevant stakeholders (the Enlarged Stakeholder Board) if gathered to feed to the Flagship Programs. Are there any more available methodological descriptions available?
4. Has Biodiversa+ encountered any challenges to well-functioning research prioritisation? Are there any other advice you would like to give to the SSBD, to avoid potential past mistakes, improve the current landscape and foresee challenges?

Annex III: Structures and functionality of EPBRS

European Platform for Biodiversity Research Strategy (EPBRS) was a forum for scientists, policymakers, and other stakeholders to identify the strategically important research that was essential to use the components of biodiversity in a sustainable way, maintain ecosystem functions that provide goods and services, conserve, protect and restore the natural world and halt biodiversity loss. EPBRS guided research prioritisation around biodiversity questions in EU 1999-2017 after which it was discontinued due to lack of funding and changes in research prioritising landscape, including new protocols for consulting member states via Programme Committees. This Annex describes the structure and functionality of EPBRS based on interviews with the former EPBRS members.

EPBRS Origins:

EPBRS was initiated through the work by Martin Sharman, stemming from the lack of a framework for scientists to discuss what science should be conducted to help with policymaking around biodiversity. As a result, the members of the 'Northern Dimension of Biodiversity' Symposium (organized by the Finnish presidency in Ivalo, 1999) recommended such a body, creating basis for EPBRS. The recommendation was presented as a statement to FP Environment Programme Committee of the Member States, also inviting for the first delegate nominations. Under the next presidency, there was a meeting centred around EPBRS (organized in Ponta Delgada, Açores, Portugal, 2000), resulting to the "Declaration of the Ponta Delgada meeting on biodiversity research". Martin Sharman was responsible to look over the follow-up for this declaration, particularly by being in touch with the next presidency country, to help to shape and guide the topic and the participants for the next EPBRS meeting.

Selection of participants:

Membership in the EPBRS was open to all member and associated member states that participated in the 6th FP (2002-2006), the 7th FP (2007-2013) and the Horizon 2020 (2014-2020) Framework Programme. The states that joined EPBRS were each asked to nominate one scientist, from natural or social sciences, and one policymaker to represent the state, under each 6-month country presidency. These delegates were selected by already existing national Programme Committees of the successive EU Framework Programmes for Research and Innovation that had the task of observing how European Commission coordinated environmental research. Each state however decided how exactly the selection process of delegates was to be done: in practice, it was often based on internal national discussions within national ministries of environment and/or research, on who happened to hold relevant positions in government or research institutions, and on who happened to be connected to whom; Programme Committees also often appointed themselves as either policy delegate or scientist delegate (if they held relevant positions and expertise), and selected the other delegate form someone they knew. Selection of delegates thus involved subjectivity with regards to personal connections, affinity, shared membership of national committees or working groups. Delegate selection was also influenced by who's organization or position enabled financing the delegate's participation.

The members states coordinated EPBRS work through "National Platforms", but these platforms functioned very differently in different countries: In some instances, a specific committee was set to steer the EPBRS-related work, involving hired employees, and these platforms could select the delegates. In France and Belgium, for example, the platforms were well-structured and developed to still-existing institutions, the FRB and the Belgium Biodiversity Platform. In other instances, there was simply a person appointed to be responsible for EPBRS activities. Particularly the southern and eastern European countries lacked resources to set up functioning platforms.

EPBRS was not in a political position to decide how each country organized its platform, and it was considered important to give the states the freedom to decide about the selection of the delegates themselves to give EPBRS legitimacy from bottom-up; thanks to this, EPBRS meetings quickly rose in prestige in EU policy context. It is however unknown whether any democratic or open processes for delegate selection were in place within the National Platforms. Later the projects BIOPLATFORM (2001-2005) and BioSTRAT (2007-2009) aimed at supporting the less functional National Platforms, but according to two interviewees, these projects could have delivered better results. In practice, the platform functionality also depended a lot on people involved and their persuasion capacities: the governments and research organization needed to see a functioning National Platform as something they need and have advantage of from supporting.

The delegates elected the EPBRS Steering Committee, which consisted of a Chair, a Co-chair, and a Secretariat (6-8 people altogether). In addition, the delegates helped the Steering committee and host states in selecting thematic experts around specific biodiversity topics for each EPBRS meeting. This expert selection was also often based on personal connections and experts' positions in research organizations. The structure of changing experts for each meeting combined with more permanent delegates was however considered as a good compromise between participant continuity and flexibility.

There was variation in the number of delegates based on the funding each country had available: some states sometimes send in more representatives in addition to the official two delegates (even up to five or six), who were allowed to join if the host country had the resources to accommodate them. Some countries could also send in two science delegates and no policy delegates. Meanwhile some states, often in the lack of funding, send only one or none. Also, the EPBRS Secretariat was often from Belgium Biodiversity Platform as this platform had employees that could commit to Secretariat tasks. There were two projects established to aid in creating National Platforms and to help involving delegates from all states (a Specific Support Action BioStrat), especially from eastern Europe, but this only provided some help for evening up the participation rates.

The scientist delegates tended to be natural scientists, particularly ecologists, botanists or zoologists; especially at the start of EPBRS there were no single social scientist among the delegates. The same tended to apply to thematic experts, and particularly economists were lacking. The main driver of the lack of social scientists appeared to be that people simply tend to think that natural scientists are most relevant for defining research gaps around biodiversity problems. To enable more participation from social scientists, up to two scientist representatives were eventually invited in addition to the official scientist delegate, yet participation was still biased towards natural scientists. Some meetings aimed particularly at transdisciplinary results, e.g., EPBRS meeting on 'Biodiversity and Economy' in France 2008, but even there almost all economy experts had left by the recommendation-drafting day.

Part of the experts who participated in the e-conference were invited to attend the meeting; how many and who was a choice of the EPBRS Steering committee and the host country depending on available resources.

Meeting procedures:

There was one EPBRS meeting under each 6-month country presidency. The meetings were co-organized by EPBRS and the national government of the presidency country, in practice by the ministry of research or ministry of environment of the presidency country which would either function as a host organization or appoint a research organization as a host organization; the decision of the hosting organization was up to each presidency country.

The original starting point for the EPBRS recommendations was to "identify policies for which biodiversity and ecosystem services knowledge is important". This step was however more of a sideline and was not formalized, nor was there a systematic process for defining the relevant policies. Instead, there was a process of selecting a topic in collaboration with the presidency country, which often involved country's political interests and/or were connected to ongoing international policy developments; EC could also involve into the process. Note that in the times of EPBRS, it was also not so straightforward to identify the relevant policies as the legislation framework was much less developed around biodiversity as it is nowadays.

Different countries had different topic preferences based on their interests – Slovenia, for example, wanted to concentrate on fresh water, and Finland on forest biodiversity. Often topics were compromises between the host country interests and relevance to Europe-wide community – Austria, for example, wanted to discuss mountain biodiversity, but for the interest of the southern mountainless countries, also sea mountains were included. Often the topic selection was a matter of getting the presidency country excited about a topic and ready to invest into the meeting. The topic selection process also varied some form presidency to presidency, depending on the stance of the presidency country: Sometimes it was mainly the Programme Committee representative furthering the topic discussion, sometimes the country set up a small, specific committee for it. After selecting the topic, the EPBRS Steering committee identified relevant topic experts in collaboration with the presidency country.

Before the meeting, there was "an online conference" or "pre-meeting". These events had an informal, discussive approach, and could involve reviewing relevant literature (for example, UK commissioned a literature review once), but this background research was not necessarily in-depth, systematic, nor formalized. The participants included EPBRS delegates, but could also involve a wider community of experts, often amounting to around 50 or even up to 80 people, depending on the interest in the topic. The participants could also include people outside the natural scientist community, yet how wide the participation was depended on how well EPBRS and the presidency country disseminated and advertised the event (this was done for example via e-mail channels); it was a responsibility of each presidency country to ensure there were enough experts on the topics at hand. In practice, it was the natural scientists who led the process, and policy representatives acted as commissioners of the work. The composition of the participants also depended a lot on the resources and network of the presidency country delegates. Note that the online format was not as high-tech as today (one method used was pre-agreed time slots to exchange chat messages), and that the outputs depended a lot on the people who happened to be active. The output of the "online

conferences" or "pre-meetings" were summarized for the actual EPBRS meeting, to be used as the basis of discussions. These occasions were also used to define the thematic experts for the actual EPBRS meeting.

The formal EPBRS meeting lasted for 2-3 days, usually from Friday to Sunday. The presidency country would identify up to three speakers (usually one scientist, one policy representative, and one pulling science and policy perspectives together) who would present the topic from their perspectives, with to identify areas of particular scientific and polity interest. These presentations would take the first morning of the meeting, but the presentation time was kept at ~20min each to maximise the discussion time. The speakers were also invited to send any preparation material or relevant background information to delegates beforehand, so that they had an opportunity come in prepared.

After the presentations, the priorities were refined through discussion in small working groups. The aim was to have 3-5 breakout groups with 5 to 6 people each, although the exact practices varied between meetings. Each group was asked to come up with 10 important topics that are scientifically interesting and politically important, with a chairperson leading the discussion; The choice of chair of the groups was always made carefully, as the selected person could influence the course of discussion. The resulting 10 topics were then presented to the plenary. The Secretariat of the meeting (usually consisting of ~5 people, working late into the night of the first day) would collate all topics.

Next day the resulting set of draft recommendations would go back into working groups to be refined; at this stage, each working group got a task to look at the recommendations from a certain perspective. The recommendations were refined and formalized, with the aim to formulate them for the relevant audience. Yet, in practice the process was highly dynamic: some groups kept the focus from the previous day, some took new directions. Also the group compositions could vary as people come and went. This work resulted into a second draft, presented for discussion in a plenary, which would assemble the final draft recommendations in a line-by-line agreement.

The meeting discussions involved a lot of negotiations among delegates. It was clear however that many delegates had a background in ongoing other negotiations, such as the ones for CBD-SBSSTA and its priorities for CBD, so what was discussed was not necessarily single people's opinions but reflections from wider policy processes.

The delegates had varying views on the basis that should be used to prioritise topics, but there were also common outlines: for example, it was assessed how feasible it would be to tackle a topic in a policy-relevant time frame. Also, the recommendations aimed at being useful for the target audience, namely the EC and the member states.

After the meeting, the recommendation daft was cleaned by EPBRS, again to be send for the member states for potential final comments and eventually approval. The member states that did not participate in a meeting still received the recommendations afterwards; and the topics were never so politicized that such absent countries would have questioned the recommendations.

The meeting processes did not include formalized horizon scanning activities. Many topics however had foresight aspects, such as effects of future climate change, which were discussed for example in the working groups of the official meetings. There was also a joint meeting with Biodiversa+ to define and discuss NBS, which was a new topic back then, in need of definitions and visions. Furthermore, there was one special townhall event organized in Brussels 2010, with the title

"Positive visions for biodiversity". The CBD targets had recently been missed, and there was a need to figure out what should be done differently, inspiring the event: the aim was to think of positive visions for the future of human and nature and come up with ways to reach them. This event was however very different from the usual EPBRS meetings: The event brough together more than 200 people, involving not just scientists and policymakers but also other societal sectors, e.g., from arts, economists, business, education, religion, and journalism. Participants were gathered into a large room with 20 tables, with 10 people and a moderator at each, discussing a certain table-specific topic with a bottom-up approach, aiming at defining what needs to be done for positive future for biodiversity. The results of this event were however very generic.

Funding:

EPBRS did not monitor the overall expenses of its activities. It was funded varyingly from diverse sources and planning often being opportunistic:

EPBRS started through project funding to Bioplatform and later to Biostrat, aiming at strengthening the dialog between science and policy.

The core funding for EPBRS meetings came from each consecutive presidency country, who would also decide how much funding they could afford to allocate to the meeting. In practice, it was usually a ministry of the presidency country which would function as the host organization, or a research organization which would receive the meeting funding from a ministry. In addition, Bioplatform and Biostrat projects provided support for covering travel expenses, allocated to National Platforms.

One interviewee approximated an average EPBRS meeting costs to be 30 000 - 40 000 euros, including travel expenses for 30-40 people.

Meeting participants were not paid for their participation, so the contributions were considered in kind or covered by the work hours of participants' employee organizations, perceived as a part of participants' work duties – thus the participation depended a lot on the flexibility of different employees.

There were also some jointly organized and funded activities, such as workshops, with developing Biodiversa+, as well as with Alternet and Alarm, but these connections were quite loose.

The interviewees gave somewhat varying information about the funding of the EPBRS Secretariat, potentially due to varying practices in time: first, Martin Sharman was paid by EC to use 25% of his work time on EPBRS Secretariat. Later the Secretariat continued engaging one person with about 25% work time contribution, but the funding came from the National Platform of Belgium; note however, that the Secretariat's work time varied considerably in time, going from full-time engagement before meetings and events to much more quiet periods. Note that one-person 25% work time contribution only covered a small part of EPBRS Secretariat work; also the chair and the co-chair had considerable responsibilities.

For the "Positive visions for biodiversity" event in Brussels 2010, there was also fundraising from National Platforms, NGOs and UNESCO, who co-funded the event and thus gained visibility.

Linkages to other bodies:

Connections between EPBRS and other bodies depended a lot on which institutions the EPBRS meeting participants had their affiliation. Most connections functioned by EPBRS participants communicating EPBRS processes and results in the meetings of their employee institution, be it an international body, a national government, a research organisation, an EU institution, or an EU project. In other words, the connections were many and diverse, but often not formalized nor monitored.

EBPRS connected to EC particularly to DG RTD and DG ENV, mainly through personal connections and affiliations. Membership in the EPBRS was kept "open to the EU institutions" to ensure that representatives from EC could participate fully and not just as observers. This also enabled, for example, EEA staff, the Committee of the Regions, and associate countries to participate. EEA and Joint Research Centre were connected to EPBRS through personal connections, as well as participating the committee meetings as observing, ex-officio members; they had no voting power and were not influencing EPBRS processes but could attend events and use the outputs. Existing EU projects were often involved in the pre-meetings and meetings by sending in participants, as well as relevant experts from varying research institutions. EPBRS meetings could also be attended by representatives of the European parliament, Diversitas, and later developing Alternet and Biodiversa+. Many EPBRS participants were also contributing to IPBES or working as delegates to CBD-SBSTTA, and EPBRS also send representatives to early IPBES meetings. EPBRS participants were also often aware of the research needs of different stakeholder through external stakeholder meetings.

EPBRS recommendations were aiming at supporting European Commission, Council and Parliament and the EU Member States, but were taken up by different institutions to varying degrees:

Originally EPBRS communicated the recommendations to EC through Martin Sharman, who was the Commission member responsible for reporting on EPBRS activities to the FP Environment Programme Committee of the Member States. He was also the Secretary of the platform, responsible for assembling its recommendations and providing them to the platform members, including not just the Programme Committee but also DG RTD. Later, EPBRS outputs were communicated to EC more formally.

The presidency country or other countries could use EPBRS outputs for their policy decision, but this process was up to each country and not monitored by EPBRS. Once, for example, Germany took up EPBRS recommendations to feed into CBD processes. If a delegate was affiliated to a ministry, he/she could take EPBRS recommendations there directly, but for people affiliated to research institutions dissemination possibilities may have been more limited.

Different research institutions would hear about EPBRS outputs from their representatives. EPBRS results were often also be presented to other relevant international bodies in various central meetings, such as meetings for Nature Directives or CBD. One interviewee also mentioned European delegations to the CBD and the Council Working Party on International Environmental Issues as a part of the audience for EPBRS outputs.

Towards the end of the active period of EPBRS, its role in influencing the Horizon calls content started to diminish, and Biodiversa+ took over some of the roles of EPBRS. The Belgium Biodiversity Platform is still hosting the EPBRS website (http://www.epbrs.org/), but it is not updated anymore.

Annex IV: Other advice from EPBRS

- Meetings could be organized online rather than in person with the present-day technology, to make the processes more efficient and cheaper (I2).
- EPBRS was almost always organized over a weekend, but this likely prevents some people from joining in, and also does not necessarily give a professional appearance to the meetings (I1).
- Informality in the meetings can give flexibility and opportunities, and it is easier to engage people horizontally without having a hierarchical structure (I5).
- Online pre-meetings can be used as a tool to engage wider community, perhaps also using social media (I4).
- It is an advantage to have a rather stable core team (Steering Committee) to create continuity (I3), perhaps combined with the more turnover of other participants to create flexibility (I5).
- Biodiversity problems occur at very different scales, from local to global, and thus it is crucial to define which scale we are talking about when discussing priorities (I1).
- It is crucial, yet challenging task to identify and be in touch with the core people who are steering the prioritisation process (I1).
- Member states may experience EPBRS-hosting as an opportunity or duty to show they commitment with banquets, social events, etc. in connection to the meeting, which may be hard to keep in check (I1).
- Foresight and Horizon scanning exercises, for example on effects of certain policies, could be involved more (I3).
- EPBRS engaged mostly older people, who may not have time and capacities to learn new things and keep an open mind. Younger people, such as post-docs, often have more out-of-the-box ideas and they will be the future leaders and experts and should be involved more (I5).
- When selecting delegates for new bodies, there needs to be transparency on conflict of interest (I2).
- SSBD Research prioritising delegates should be selected based on the eventual purpose of the group (I1).
- There may be a need for more knowledge on the international consequences of policy actions, on both local and global levels; e.g., if one country decides to produce something, how does this reverberate to other countries across global economy (I2).
- The results of the 2010 “Positive visions for biodiversity” meeting in Belgium were hard to formulate as recommendations due to their highly general nature involving fundamental societal questions (I4).