Benchmark for integration of biodiversity in Environmental Assessment Instruments

D2.1: Benchmark of the best practice of EAI in relation to biodiversity
WP2, Task 2.1

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This report and its contents are an expression of the authors' knowledge and conclusions and do not necessarily represent all BioValue partners. This is the first version of the report, it will be revisited and revised at later stages in the project.

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3. Introduction

"The essence of benchmarking is the process of identifying the highest standards of excellence for products, services, or processes, and then making the improvements necessary to reach those standards - commonly called 'best practices"
(Bhutta and Huq, 1999 p. 254).

The BioValue project aims to safeguard and increase biodiversity through transformative change in spatial policy-making, planning practices and infrastructure development, upscaling opportunities for valuing biodiversity in support of EU strategic actions on biodiversity, particularly, the EU Biodiversity Strategy 2030. IPBES (2019) recognises the relevance of comprehensive environmental assessments instruments (EAI), such as environmental impact assessment (EIA) and strategic environmental assessment (SEA), as supporting instruments to mitigate the impacts of development activities on biodiversity and ecosystems to promote cross-sectoral approaches constructing pathways towards sustainability aligning with the SDGs. IPBES also states that EAI are crucial for spatial planning, proposing that they can play a role in guaranteeing more integrated, resilient, and sustainable outcomes of planning processes. Also, the EU Biodiversity Strategy 2030 indicates that to enable transformative change for European biodiversity, it is imperative to commit, implement and enforce (and where necessary review and revise) EU environmental legislation, where both the EIA and SEA Directives are included.

This benchmark reported is carried out in line with the purposes of the BioValue project. The specific purpose of the benchmark is to:

A. Identify the current best practice guidance of integrating biodiversity into EAI especially related to spatial planning (the main purpose of this report).
B. Compare the current best practice guidance to the current actual practice with the aim of improving the practice (comparison that will be made in Task 2.2).
C. Establish an improved best practice guidance.

This report documents the first part of the benchmark exercise relating to the first part of the purpose (A). Here, a benchmark is derived from twelve guidance documents focussed on biodiversity in EAI (task 2.1). The guidance documents are reviewed based on a framework of questions that are a mix of open and closed questions allowing for both structured and more grounded analysis (see table 4). Based on this, a benchmark is developed, which consists of closed questions allowing for a structured and quantitative analysis of a large number of EAI reports (tasks 2.2 and 2.4) relating to the second part of the purpose of the benchmark (B). During these stages, the benchmark will be revisited, and relevant revisions will be made based on finding in literature and practice.

In the later stages in the BioValue project, this will, together with knowledge from other parts of the project be used for development of a transformed practice (C). It is relevant to mention that this last part of the purpose goes beyond the definition of benchmarking by Bhutta and Huq (1999), as the BioValue project is not only concerned with development to reach the current best practice but to push much further, towards defining a new transformed practice.

3.1. Integration of biodiversity in decision-making and spatial planning through EAI – an EU perspective

As stated, EAI (notably EIA and SEA), have an important role in assessing the impacts of spatial policy and planning proposals on biodiversity. EIA and SEA are used at various decision-making levels for different sectors and activities and should constitute a comprehensive assessment of the total impacts on local biodiversity - and should protect it from deteriorating incrementally. This role of EIA and SEA is recognised at regional level by the European Union (as seen previously by the EU Biodiversity Strategy) as well as at international level (like IPBES).

In 2019 the EU published a guidance on the Integration of ESS in decision-making processes, based on the EU Biodiversity Strategy 2020 and the European Action Plan for Nature, People and the Economy (COM(2017) 198 final). The guidance identifies EAI, such as SEA and EIA, as supporting instruments for the integration of biodiversity and ESS in policy formulation, in planning, and in the development of large projects. They identify EAI instruments, specifically, as supporting integration of knowledge and values in decisions, into spatial planning across all sectors, and subsequent infrastructure development. For SEA, it stated that: *"SEA should help to build biodiversity and ecosystem services objectives into land use, urban and sectoral policies, plans and programmes, (…) identify and manage apparently minor impacts which may pose severe threats to biodiversity, (…) identify alternatives and mitigation strategies".*

It has been suggested that EAI should integrate the concept of 'no net loss' as a framework for assessment (e.g., Gutierrez et al. 2021) and that offsetting or compensation for impacts are much-used measures. This practice is debatable compared to a more proactive approach avoiding impacts (e.g., Larsen et al. 2018). The EU also recognised the strong potential of alignment between EAI and mitigation. Besides the fact that mitigation is one of the purposes of EIA and SEA as seen in the respective EU Directives, the 2020 Guidance on Achieving No Net Loss or Net Gain of Biodiversity and Ecosystem Services is set to be a 'complement' to avoidance and mitigation measures established through EAI. As mentioned in this Guidance, EAI "*also require the application of the mitigation hierarchy and compensation/offsetting of unavoidable impacts on nature and environment*".

These elements of what the expected role of EAI instruments is in the integration of biodiversity in decision-making and spatial planning supports the analysis and underlines the relevance of some elements of the benchmark.

3.2. Structure of the benchmark

Based on the above, the benchmark is a form of yardstick, against which EAs can be measured to see to what degree they comply with best practice. The guidance documents cover both SEA and EIA, and in the benchmark the term Environmental Assessment (EA) is used as a broader term covering both types of instruments. The benchmark consists of 10 themes under which there are a number of indicators of best practice for integrating biodiversity in environmental assessment instruments. The themes and indicators are summarised in table 1.

Table 1 Themes and indicators of the benchmark. These are further specified in the following sections.

Themes	Indicators
A – Role	*How is biodiversity integrated in the EA process? (A1)*
	How is EA and resulting knowledge about biodiversity impacts integrated in the planning process? (A2)
B - Significance	*What methodology is used to evaluate the significance of biodiversity impacts in the EA? (B1)*
	Which types of parameters are relevant for evaluating significance of biodiversity impacts in the EA? (B2)
C – Knowledge	*Which types of knowledge is used for working with biodiversity in the EA? (C1)*
D - Synergies and trade-offs	*How are synergies and trade-off between biodiversity and other sustainability aspects handled in the EA? (D1)*
E – Ecosystem service	*Which types of knowledge is used for working with biodiversity in the EA? (E1)*
F – Goals and Visions	*How should biodiversity goals and visions be integrated in EA? (F1)*
G – Uncertainty	*How should the EA process deal with 'the unknown'/uncertainty concerning biodiversity? (G1)*
H – Involvement	*Who are involved in the integration of biodiversity in the EA? (H1)*
I – Mitigation and enhancement	*Who are involved in the integration of biodiversity in the EA? (I1)*
	To what degree are biodiversity impacts mitigated in EA? (I2)
	How are financial instruments used in the EA? (I3)
J – Monitoring and follow-up	*How does the EA specify monitoring of biodiversity impacts? (J1)*
	What is the monitoring of biodiversity impacts specified in the EA aimed at? (J2)
	What does the EA specify that monitoring of biodiversity should be used for? (J3)

For each of the indicators, there are two or more possible elements or answers, and the level of compliance with the indicator and thus best practice is measured differently depending on the question.

In table 2 an overview of where the different guidance documents have contributed to the benchmark are provided.

Table 2 Overview of where the different reference documents contributed to the benchmark.

	Role	Significance	Knowledge	Synergies and trade-offs	Ecosystem services	Goals and visions	Uncertainty	Involvement	Mitigation and enhancement	Monitoring and follow-up
CBD (2006)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CBBIA - IAIA (2006)	✓	✓	✓		✓	✓	✓	✓	✓	✓
CBBIA - IAIA (2007)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BBOP (2009)	✓	✓	✓	✓	✓		✓	✓	✓	✓
Irish EPA (2012)	✓	✓						✓	✓	✓
European Commission - EIA (2013)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
European Commission - SEA (2013)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MFI (2015)		✓	✓				✓	✓	✓	✓
IAIA (2018)	✓	✓	✓	✓	✓		✓	✓	✓	✓
EIB (2018)	✓	✓	✓		✓		✓	✓	✓	✓
IAIA and GBIF (2020)	✓								✓	✓
IFC (n.d.)	✓	✓	✓		✓			✓	✓	✓

In the following sections, the entire benchmark is reported, including for each indicator:

- the elements,
- the rationale for having the indicator,
- And how to measure the indicator.

In the final section of this report, the methodology behind developing the benchmark is presented.

A – Role

A1 – Indicator: *How is biodiversity integrated in the EA process?*

Elements:

- *Biodiversity is integrated from an early stage in the EA process.*
- *Biodiversity is integrated throughout the EA process.*

Measurements: How many elements does the EA comply with? The more elements, the better.

Rationale:
The documents emphasise that biodiversity and ecosystem services play a critical role in supporting sustainable development. EA incorporates well established procedures for collecting and interpreting information on biodiversity and ecosystem services and: "*can be used to provide a 'before and after' picture of the distribution, status and condition of biodiversity affected by a proposed plan or project"* (BBOP, 2009 p. 7). The guidance documents highlight that it is relevant to integrate biodiversity at all the steps of an EA process. Several documents specifically point to the necessity of integrating biodiversity from an early stage and throughout the EA process.

A2 – Indicator: *How is EA and resulting knowledge about biodiversity impacts integrated in the planning, design and decision-making process?*

Elements:

- *The EA and biodiversity considerations are integrated from an early stage in the planning or design process*
- *EA and biodiversity considerations are integrated throughout the planning or design process*
- *Mitigation measures for biodiversity are integrated in the planning or design process*
- *EA and biodiversity considerations are integrated in the decision-making process*

Measurements: How many elements does the EA comply with? The more elements, the better.

Rationale:
An EA is the process of assessing a possible future activity such as a strategy, plan, or project for which there is some form of a planning or design process and a decision-making process to which the EA can contribute. The guidance documents stress that biodiversity should be considered at the earliest possible stage of planning, design and decision-making processes, and that mitigation measures should be integrated in both the planning process and the outcome. Thus, moving from a more reactive to a more proactive approach to securing ecological sustainability. A further point from the guidance documents is that the EA and biodiversity considerations should be integrated starting already at the strategic decision-making level. This point is not relevant to measure for an EA seen in isolation (such as in a benchmark) but is an important point in a wider perspective.

B – Significance

B1 - Indicator: *What methodology is used to evaluate the significance of biodiversity impacts in the EA?*

Elements:

- *Compare impacts to reference situation/0-alternative.*
- *Compare impacts against thresholds, criteria, and targets.*
- *Compare impacts to sensitivity of impacted entity.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale: Evaluating significance is a crucial and challenging point of any EAI-process also when integrating biodiversity and thus evaluating the significance of impacts on biodiversity. In four of the guidance documents, assessment of significance is mentioned as a matter of expert judgement, while one document emphasizes the need to consult with stakeholders and factor in their values and levels of concern. In the reviewed guidance documents, different methodologies for evaluating the significance of biodiversity impacts are deemed relevant. In terms of comparing against thresholds, criteria and targets, these could be both biodiversity-specific from e.g., national biodiversity strategies, or from a broader background, such as targets and criteria from the UN SDG framework. An example of such a target from the SDG framework, which has been used in EA practice is (Boess et al. 2022): *15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species* (UN 2022). Using such a target could for example mean comparing whether an impact would degrade natural habitats, cause biodiversity loss or endanger threatened species – if yes, this indicates the significance of that impact.

B2 - Indicator: *Which types of parameters are relevant for evaluating significance of biodiversity impacts in the EA?*

Elements:

- *Parameters related to characteristics of the activity/impact on biodiversity.*
- *Parameters related to characteristics of the impacted biodiversity entities.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
The documents point to many parameters of importance when evaluating significance of biodiversity impacts including the risk of extinction of populations, species etc.; biological resources of value/use to local population; resilience of the impacted resource, area, habitat, species etc.; size, frequency, reversibility, likelihood, certainty, and duration of the impact; and protected, sensitive or valuable areas, habitats, species etc. These parameters overall cover two types of parameters namely those related to characteristics of the activity or impact and those related to the characteristics of the impacted entities.

C- Knowledge

C1 - Indicator: *Which types of knowledge is used for working with biodiversity in the EA?*

Elements:

- *Expert knowledge.*
- *Multidisciplinary knowledge.*
- *Local and indigenous knowledge.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
An important issue in relation to integration of biodiversity in EAI is what types of knowledge should be used for this integration. Ten of the analysed documents underline the need to use expert knowledge, while four of them further specify a need for multidisciplinary knowledge. Eight of the documents stress the need to not only rely on expert knowledge but include local, traditional, or indigenous knowledge and in general knowledge from local stakeholders including local authorities.

D- Synergies and trade-offs

D1 - Indicator: *How are synergies and trade-off between biodiversity and other sustainability aspects handled in the EA?*

Elements:

1. *Acknowledging that synergies and trade-offs exist.*
2. *Identifying synergies and trade-offs.*
3. *Managing synergies and trade-offs (if relevant).*
4. *Taking trade-offs into account in decision-making (if relevant).*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
Synergies and trade-offs between biodiversity and other aspects of sustainability, namely other social, cultural, economic, and environmental issues, is mentioned as an important element in six of the reviewed documents.

> *"It is important that there are clear criteria for taking biodiversity into account in decision-making, and to guide trade-offs between social, economic and environmental issues including biodiversity" (CBD, 2007 p- 17).*

E- Ecosystem services

E1- Indicator: *How are ecosystem services used in the EA?*

Elements:

1. *Acknowledging the importance of ecosystem services.*
2. *Mapping ecosystem services.*
3. *Identifying users/beneficiaries of ecosystem services.*
4. *Assigning values to ecosystem services.*
5. *Evaluating impacts on ecosystem services from the activities.*
6. *Mitigating impacts on ecosystem services (if relevant).*
7. *Monitoring ecosystem services (if relevant).*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
According to the analysed documents conservation of ecosystem structure and functions, with the purpose of maintaining ecosystem services, should be a priority target. Mapping the ecosystem services or land-use types should take place, in consultation with stakeholders, especially vulnerable stakeholders, to determine the values of these functions for society and to determine levels of protection, conservation and monitoring.

> *"For ecosystem services, IA should be used to identify ways in which ecosystem extent, health, and functionality can be safeguarded or enhanced, allowing the values and benefits derived from ecosystem services to be sustained over time" (IAIA, 2018 p. 3).*

F- Goals and visions

F1- Indicator: *How are biodiversity goals and visions be integrated in the EA?*

Elements:

- *Through including conservation priorities and targets from EU Biodiversity Strategy, National biodiversity strategies or other existing guidance documents (e.g., international, and national, regional, and local laws, policies, plans and strategies) in Action plans.*
- *Deciding on a 'vision', with explicit goals, objectives, desired outcomes.*
- *Through applying an ecosystem-based approach.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
The analysed documents emphasise the importance of: "*deciding on a specific 'vision', with explicit goals, objectives, desired outcomes and/or targets of the strategic proposa*l" (CBBIA – IAIA, 2006 p. D-4). These criteria should be based on existing policy and guidance documents, such as the EU biodiversity Strategy, other biodiversity action plans, international, national, and local legislation and/or by using an ecosystem-based approach, as these conservation priorities and targets, can guide the further development of EIA screening criteria.

G – Uncertainty

G1 - Indicator: *How does the EA process deal with uncertainty concerning biodiversity?*

Elements:

1. *Ensure transparency about lack of data, gaps in knowledge, and uncertainty*
2. *Take a precautionary approach to impacts*
3. *Identity gaps in knowledge and gather additional information (if relevant)*
4. *Manage uncertainty e.g. using adaptive management, scenarios etc. (if relevant)*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
Eight of the analysed document point to the application of the precautionary approach in decision-making when there is a risk of significant harm to biodiversity. Three documents point to the importance of identifying and decreasing knowledge gaps, and six of the documents emphasize the importance of ensuring transparency by clearly stating lack of knowledge and data, uncertainty in methods, and the level of certainty in each impact prediction. In the reviewed documents, different methods for dealing with uncertainty of biodiversity impacts in the EIA process are deemed relevant.

H – Involvement

H1 - Indicator: *Who are involved in the integration of biodiversity in the EA?*

Elements:

- *Authorities,*
- *Decision-makers,*
- *Professionals,*
- *Stakeholders,*
- *General public,*
- *Local level,*
- *NGO's.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
According to the document an effective participation of relevant stakeholders is a precondition for a successful EIA. Thus, it is important early in the process to identify, bring together and establish proactive communication and involvement with all the stakeholders and environmental authorities to help identify the key issues.

Eight of the analysed documents mention the Authorities (e.g., those responsible but also affected at both international, national, sub-national and local level), two documents mention the Decision-makers, seven documents mention the Professionals (e.g., both planners, the developer, engineers, practitioners, consultancies and experts), seven documents mention the Stakeholders (both those with direct and indirect access), four documents mention the General public (both the private and public sector), six documents mention the Local level (including indigenous communities), and finally six documents mention the NGOs. Involvement of the relevant stakeholders will also help reduce uncertainty.

I- Mitigation and enhancement

I1- Indicator: *How are biodiversity impacts mitigated in the EA?*

Elements:

- *Biodiversity impacts are mitigated in accordance with the mitigation hierarchy.*
- *Biodiversity impacts are mitigated based on analysis of residual impacts.*
- *Biodiversity impacts are mitigated through enhancing biodiversity values.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale: Eleven of the twelve reviewed documents prescribe that mitigation should follow the mitigation hierarchy, meaning that it should be prioritized to biodiversity impacts, then to minimize biodiversity impacts and so forth. Six of the documents prescribe that mitigation measures should be chosen based on an ongoing analysis of the residual impacts on biodiversity including mitigation measures. According to eight documents, enhancement is also an important element in mitigation, according to the documents this primarily takes the form of maximizing existing biodiversity values or creating new ones.

I2 - Indicator: *To what degree are biodiversity impacts mitigated in the EA?*

Elements:

1. *Biodiversity impacts are mitigated so that 'no net loss' is achieved.*
2. *Biodiversity impacts are mitigated so that 'net gain' is achieved.*

Rationale: Seven of the documents state that mitigation and enhancement should continue until 'no net loss' or 'net gain' of biodiversity is achieved.

Measurement: Scale where 2 is best.

I3 – Indicator: *How is the implementation of mitigation supported by financial instruments?*

Elements:

- *The necessary financial settings for implementation of mitigation measures incl. compensation/off-setting are established (if relevant).*
- *Financial incentives are provided for proponents to protect biodiversity (if relevant).*
- *Financial settings for maintenance of biodiversity are established (if relevant).*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
Four of the guidance documents point out the need to support mitigation by using financial instruments. When looking in isolation at the EA process, of course this cannot be decided in the EA and it should be at an appropriate scale, i.e. an EA cannot be expected to be the basis for providing national financial schemes and legislation. However, an EA could for example be the basis for suggesting and implementing a local fund for securing maintenance of restored biodiversity after a project has been established. The importance of taking such considerations already at the time of the EA is stressed by the EIB: *"The need for funds, legal frameworks and institutional capacity to be planned well in advance so that they are in place to allow offset implementation to begin in advance of significant impacts from the project – biodiversity-related finance should therefore be discussed during the appraisal stage"* (EIB, 2018 p. 24).

J- Monitoring and follow-up

J1 - Indicator: *How does the EA specify monitoring of biodiversity impacts?*

Elements:

- *There are plans to establish monitoring of biodiversity impacts.*
- *Clear targets, indicators, and responsibilities for monitoring of biodiversity impacts are specified.*
- *Plans for monitoring are linked to sound baseline information.*
- *Plans for monitoring specify that stakeholders should be involved.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
Nine of the analysed documents emphasize that it is essential to ensure management plans, programs, and systems, including specific, measurable, achievable, relevant, and timely management targets and indicators, and appropriate monitoring of biodiversity impacts. Including who should be involved and responsible for monitoring and follow up.

"Monitoring (in the third biodiversity assessment phase) should be designed to detect impacts that may have been considered initially insignificant but elevate over time, to track the implementation of mitigation measures, to follow up on the effectiveness of the mitigation strategy and to identify the need for contingency arrangements or corrective actions" (EIB, 2018 p. 19).

J2 - Indicator: *What is the monitoring of biodiversity impacts specified in the EA aimed at?*

Elements:

- *Validating the predicted biodiversity impacts.*
- *Validating the outcomes of mitigation measures.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
Data from biodiversity baseline assessment and monitoring plays a crucial role in understanding current and potential future impacts of development on the natural environment. Thus, the documents emphasize how the predicted biodiversity impacts, and outcomes of mitigation measures should be highlighted in the EMP and offset planning document (if produced) as it should be used as the basis for designing or scoping any monitoring program.

J3 – Indicator: *What does the EA specify that monitoring of biodiversity should be used for?*

Elements:

- *Implementing adaptive management.*
- *Building knowledge for future EAs and planning.*
- *Checking compliance with conditions for approval.*

Measurement: How many elements does the EA comply with? The more elements, the better.

Rationale:
Seven of the analysed documents point to the importance of implementing adaptive management systems to ensure that IA commitments will be met, mitigation measures will be implemented and that no net loss/net gain (NNL/NG) outcomes can be demonstrated through monitoring, auditing, and reporting. Implementing adaptive management will ensure an appropriate reaction to protect biodiversity if there are discrepancies between what was foreseen in the EA and what emerges when the activity is actually implemented. Systematic monitoring arrangements will also improve management policies and practices as the information will improve the accuracy of assessments at plan/programme review and by learning from the outcomes of previously employed policies and practices.

4. Applied methodology

The benchmark is derived from best practice guidance documents using a mostly grounded approach and open coding. In the following the methodology is presented in detail:

1. The approach to choosing the guidance documents for review.
2. The process of reviewing the documents.
3. The method for coding and analysing the data.

Choosing guidance documents as basis for benchmark

The guidance documents included in building the benchmark have been selected using the following criteria:

- Type: Should be documents that are meant to guide practice, e.g., guidance, guidelines, principles, standards
- Content: Should relate to environmental impact assessment with a broad concept of environment, e.g., not stand-alone biodiversity assessment or ecological impact assessment.
- Language: Should be in English
- Author/Origin: Should be published by national, regional, or international public agencies or recognized not-for-profit organisations. This excludes for example private consultants.
- Time: Should be published within the last 20 years, to ensure that it is relatively current best practice.

To find relevant documents, an online search was conducted using google.com. The following combinations of keywords were used to search:

- Biodiversity, impact assessment, guidance.
- Biodiversity, impact assessment, best practice.
- Biodiversity, impact assessment, principles.

The list of results found via the search were then reviewed and documents living up to the criteria were chosen. This continued until the results became irrelevant. As a final quality assurance, the team behind the benchmark have been consulted to see if any obvious omissions had been made.

The search and selection led to the documents in table 3, which are included in the benchmark.

Table 3 Guidance documents included in the review

Title		Origin	Year of publication	Geographic reach	Type of IA	Sector
Voluntary guidelines on Biodiversity-inclusive Environmental Impact Assessment		UN: Conference of the Parties to the Convention on Biological Diversity (CBD)	2006	International	EIA	Generic
Guidance Document on Biodiversity, Impact Assessment and Decision Making in Southern Africa		CBBIA - IAIA	2006	Southern Africa	IA	Generic
Best practice guidance for biodiversity-inclusive impact assessment		CBBIA - IAIA	2007	South Asia	EIA	Generic
The Relationship between Biodiversity Offsets and Impact Assessment		Business and Biodiversity Offsets Programme (BBOP)	2009	International	SEA and EIA	Generic
Final Report: Integrated Biodiversity Impact Assessment, Streamlining AA, SEA and EIA Processes. Best Practice Guidance		Irish EPA	2012	Ireland	Appropriate Assessment (AA), SEA and EIA	Generic
Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment		European Commission	2013	EU/Europe	EIA	Generic
Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment		European Commission	2013	EU/Europe	SEA	Generic
Good Practices for Biodiversity Inclusive Impact Assessment and Management Planning		Multilateral Financing Institutions Biodiversity Group	2015	International	ESIA	Generic
International Best Practice Principles – Biodiversity and Ecosystem Services in Impact Assessment		IAIA	2018	International	IA	Generic
Guidance Note for Standard 3 on Biodiversity and Ecosystems		European Investment Bank (EIB)	2018	EU/Europe	EIA and SEA	Generic
Best Practices for Publishing Biodiversity Data from Environmental Impact Assessments		IAIA and GBIF	2020	International		Generic
A Guide to Biodiversity for the Private Sector		International Finance Corporation (WB)	N.D	International	SEIA	Private sector (generic)

Review and coding of guidance documents

The chosen guidance documents were reviewed with a focus on a number of questions, which can be seen in table 3. These questions are inspired by:

- The basis and purpose of the BioValue project including discussions with the partners at the kick-off meeting.
- The framework for transformative change used in the BioValue project (see Wittmer et al. 2021).
- Pre-existing knowledge about biodiversity and EAI.

Table 4 Questions used for reviewing the chosen guidance documents

Objectives: What is the purpose of integrating biodiversity in EAI?	What is the expected/intended role of EAI in improving biodiversity? (Q1)
	What triggers the inclusion of biodiversity into EAI? (Q2)
Methods: How should biodiversity be integrated in EAI?	How should the significance of biodiversity be assessed in EAI? (Q3+Q4) Where in the EAI process is significance of biodiversity decisive? (Q5)
	What types of knowledge should be used when integrating biodiversity in EAI? (Q6+Q7)
	Are synergies and trade-off between biodiversity and other sustainability aspects mentioned, and how should they be handled? (Q8+Q9) Which other sustainability aspects are the trade-offs and synergies with? (Q10)
	How should ecosystem services be used in EAI? (Q11+Q12)
Outcome: What is the outcome of integrating biodiversity in EAI?	How should biodiversity impacts be mitigated? (Q13+Q14) How should biodiversity be enhanced through EAI? (Q15+Q16)
	How should financial instruments be used to assess or mitigate biodiversity in EAI? (Q17+Q18+Q19+Q20)
	How should biodiversity impacts be monitored? (Q21+Q22) What follow-up mechanisms should be in place for biodiversity impacts? (Q23)
Process: How should the process of EAI accommodate the integration of biodiversity?	Where in the EAI process should biodiversity be integrated? (Q24)
	How should biodiversity goals and visions be integrated in EAI? (Q25+Q26) How should the SDGs be integrated in EAI and at what level (according to framework)? (Q27+Q28)
	How should the EAI process deal with 'the unknown'/uncertainty concerning biodiversity? (Q29+Q30)
	Who should be involved in the integration of biodiversity in EAI? (Q31)
	How should biodiversity in EAI be linked to spatial planning? (Q32+Q33)

During the review of the documents, any text providing answers to each of the questions was copied into a spreadsheet (example provided below in table 4). This first step yields a large amount of data in the form of text, which was further coded and analysed to develop the benchmark.

The data from the twelve reference documents were further analysed through open coding. Open coding is by Strauss and Corbin summarized as:

> *"Open coding in grounded theory method is the analytical process by which concepts are identified and developed in terms of their properties and dimensions. The basic analytic procedures by which this is accomplished are: the asking of questions about the data; and the making of comparisons for similarities and differences between each incident, event and other instance of phenomena"* (Strauss and Corbin 1990 as cited in Flick 2006, p. 300).

Thus, the purpose of the open coding process is to extract concepts from data.

The coding involved 'initial coding', 'coding' and 'coding per document'. In the initial coding the larger paragraphs of text were summarized into shorter paragraphs in order to make it possible to form an overview. In the next coding, the smaller paragraphs were synthesised into single statements to identify concepts to make it possible to compare these across the documents (Watt Boolsen, 2010). Finally, an overview of the concepts per document was provided. The coding process from beginning to end has been guided by the questions in table 3.

To illustrate how the coding was conducted, Table 5 presents an example of the coding process of the data. The first column are the direct quotes from the guidance documents, which is then coded in the following columns as described.

Table 5 Illustration of coding sequence of the guidance documents

Q14: How should biodiversity impacts be mitigated?	**Initial coding**	**Coding**	**Coding per document**
Under scoping: Consideration of mitigation and/or enhancement measures: The purpose of mitigation in EIA is to look for ways to achieve the project objectives while avoiding negative impacts or reducing them to acceptable levels. The purpose of enhancement is to look for ways of optimizing environmental benefits. Both mitigation and enhancement of impacts should strive to ensure that the public or individuals do not bear costs, which are greater than the benefits that accrue to them (CBD, 2006 p 10)	Avoiding negative impacts or reducing them to acceptable levels. Both mitigation and enhancement of impacts should strive to ensure that the public or individuals do not bear costs, which are greater than the benefits that accrue to them.	Avoidance Reduction/minimization	Avoidance Reduction/minimization Compensation Analysing residual impacts Using mitigation hierarchy Limits to compensation

Under scoping: Remedial action can take several forms, i.e. avoidance (or prevention), mitigation (by considering changes to the scale, design, location, siting, process, sequencing, phasing, management and/or monitoring of the proposed activity, as well as restoration or rehabilitation of sites), and compensation (often associated with residual impacts after prevention and mitigation). A 'positive planning approach' should be used, where avoidance has priority and compensation is used as a last resort measure. One should acknowledge that compensation will not always be possible: there are cases where it is appropriate to reject a development proposal on grounds of irreversible damage to, or irreplaceable loss of, biodiversity. (CBD, 2006 p 10)	avoidance (or prevention), mitigation, compensation (often associated with residual impacts after prevention and mitigation). Avoidance has priority and compensation is used as a last resort measure. Compensation will not always be possible: there are cases where it is appropriate to reject a development proposal on grounds of irreversible damage to, or irreplaceable loss of, biodiversity.	Avoidance Reduction/minimization Compensation/off-setting Analysing residual impacts Using mitigation hierarchy Limits to compensation	
In scoping: Define possible measures to avoid, minimize or compensate for significant damage to, or loss of, biodiversity and/or ecosystem services; define possibilities to enhance biodiversity. Make reference to any legal requirements; (CBD, 2006 p 12)	Measures to avoid, minimize or compensate for significant damage to, or loss of, biodiversity and/or ecosystem services	Avoidance Reduction/minimization Compensating/off-setting	
Alternatives and/or mitigation measures must be identified and described in detail, including an analysis of their likely success and realistic potential to offset adverse project impacts (CBD, 2006 p 12)	Mitigation measures must be identified and described in detail, including an analysis of their likely success and realistic potential to offset adverse project impacts	Analysing residual impacts	

The coding or concepts per document were shaped into the benchmark. Here, the concepts are seen as the recommendations from each guidance document connected to the questions in table 4, and thus what future EAs should be measured against and aspire to. Thus, the concepts largely make up the elements in the benchmark.

Some of the questions in table 4 were not made into a benchmark, for example Q1, as it was not deemed relevant to measure and compare the intended role of the integration of biodiversity. Also, where deemed relevant, concepts were grouped differently into the benchmark than in the original framework in table 4. This process of shaping the benchmark based on the analysis and derived concepts was supported by review and discussion in the project team.

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