



Monitoring biodiversity mainstreaming in development cooperation post-2020: Exploring ways forward

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ABSTRACT

From 2022 onwards the Post-2020 Global Biodiversity Framework (GBF) of the Convention on Biological Diversity will guide biodiversity conservation actions worldwide, which includes mainstreaming biodiversity into a wide range of activities, sectors and policies. Biodiversity mainstreaming in development cooperation is particularly relevant given the direct dependence of many communities in the Global South on biodiversity and on the benefits it provides. We conducted a Delphi survey among development cooperation practitioners at the aid provider (donor) side, to gain insight into current and future (post-2020 Global Biodiversity Framework) biodiversity mainstreaming and its monitoring. Our results demonstrate that despite efforts towards biodiversity mainstreaming and its monitoring, biodiversity mainstreaming indicators remain inconsistent and difficult to compare. The lack of biodiversity data, as well as their low accessibility and suboptimal use, and the inherent complexity of addressing biodiversity loss are considered key challenges. Respondents indicated that they strongly orient their own biodiversity mainstreaming and monitoring approaches towards international biodiversity governance dynamics. We conclude that, at least on paper, the indicator ambitions of the Post-2020 Global Biodiversity Framework are in line with the expectations and challenges of aid providers with respect to biodiversity mainstreaming. However, future effective mainstreaming of biodiversity requires indicator-based monitoring, exchange of good practices among aid partners, and a continued focus on awareness-raising regarding the linkages between biodiversity conservation and poverty reduction.

1. Introduction

Human well-being is directly and indirectly dependent on biodiversity, which supports ecosystem processes and functions (IPBES, 2019a). These benefits are known as ecosystem services or as *nature's contributions to people* (Costanza et al., 2017; Díaz et al., 2018). However increasing anthropogenic pressures threaten biodiversity, which keeps declining at an alarming rate (IPBES, 2019a; Steffen et al., 2015). Species extinction rate is 100–1000 times higher than the natural rate of species loss and 30 % of all species of mammals, birds and amphibians is threatened with extinction this century (Rockström et al., 2009).

Low-income rural and urban populations often rely directly on

functional ecosystems and on the benefits, these provide for their livelihoods and well-being (Gebre and Gebremedhin, 2019; Turner et al., 2012). Academics and policymakers alike acknowledge the urgency to address the interconnection of human wellbeing and biodiversity conservation in developing countries (Anderson et al., 2019; IPBES, 2019a; Roe et al., 2015).

Biodiversity conservation is an essential part of sustainable development (WCED, 1987). Sustainability recognises the urgent need to develop within planetary boundaries (Rockström et al., 2009; Steffen et al., 2015), and is understood as “*development that meets the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends*” (Griggs et al., 2013). This

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interconnection between biodiversity and human wellbeing has been (re-)confirmed by the Sustainable Development Goals (SDGs), in particular by way of SDG14 *Life below water* and SDG 15 *Life on land* (UN, 2015).

Improving biodiversity conservation, especially in highly biodiverse developing countries, is of central importance (Adenle et al., 2015; Hugé et al., 2020a). Hence the role of development cooperation (*sensu* OECD DAC, 2019) for biodiversity conservation and sustainable development is increasingly acknowledged among development partners, scholars and practitioners alike (Drutschinin et al., 2015; Huntley, 2014; Hugé et al., 2017; OECD, 2018). Development cooperation is a large source of financing for biodiversity-related actions (Waldron et al., 2013; CBD, 2019; OECD, 2020), whether through direct or indirect funding of biodiversity actions.

Integrating biodiversity concerns and biodiversity conservation actions into different sectors and development initiatives, is referred to as ‘biodiversity mainstreaming’ (Whitehorn et al., 2019). The underlying motivation behind biodiversity mainstreaming is that the causes of biodiversity loss lay within the remit of a range of policy domains or sectors (Hugé et al., 2020a; Karlsson-Vinkhuyzen et al., 2018). Hence, these sectors need to address biodiversity issues in order to curb the negative biodiversity trends, and even to improve the quality and quantity of nature’s contributions to people. Entry points for biodiversity mainstreaming are located at different decision-making levels (national, sectoral, project or local) and mainstreaming typically requires the inclusion of a wide range of stakeholders (IIED and UNEP-WCMC, 2013; Drutschinin et al., 2015; Hugé et al., 2020a; Whitehorn et al., 2019).

The extent and progress of mainstreaming biodiversity are

monitored by aid providers in various ways, e.g. by measuring biodiversity-related development finance using the Rio markers. This is a methodology proposed by the OECD DAC to monitor development finance targeting the objectives of the Rio Conventions on climate change, biodiversity and desertification through its Creditor Reporting System (CRS), which helps bilateral aid providers to monitor mainstreaming activities (CBD, 2016; OECD, 2018). Robust monitoring to assess ongoing biodiversity mainstreaming interventions remains a challenge though (IPBES, 2019). Mere Rio-marker based monitoring is considered to lack detail and nuance, and may lead to overestimates of biodiversity expenditure (Rachel et al., 2021).

Biodiversity mainstreaming in development cooperation is now an established stated policy goal of most multilateral (e.g. the OECD, the World Bank, the European Union) and bilateral (i.e. individual countries) providers (Drutschinin et al., 2015; Kok et al., 2008; Persson, 2009), and is supported by the international policy architecture of the Convention on Biological Diversity (CBD). The CBD Strategic Plan for Biodiversity 2011–2020 and the SDGs are of central importance in guiding biodiversity mainstreaming in development cooperation (OECD, 2018). Further, biodiversity mainstreaming in development cooperation is supported by a growing number of international organisations (e.g. the International Union for the Conservation of Nature (IUCN) (Drutschinin et al., 2015)). Fig. 1 outlines key steps in biodiversity mainstreaming and its monitoring. The extent to which international frameworks and initiatives influence actual biodiversity mainstreaming efforts in development cooperation action, however, remains largely unclear in large parts. However, Quental et al. (2011) state that international sustainability initiatives have served as a catalyst for earlier biodiversity mainstreaming (e.g. the 2000 United Nations

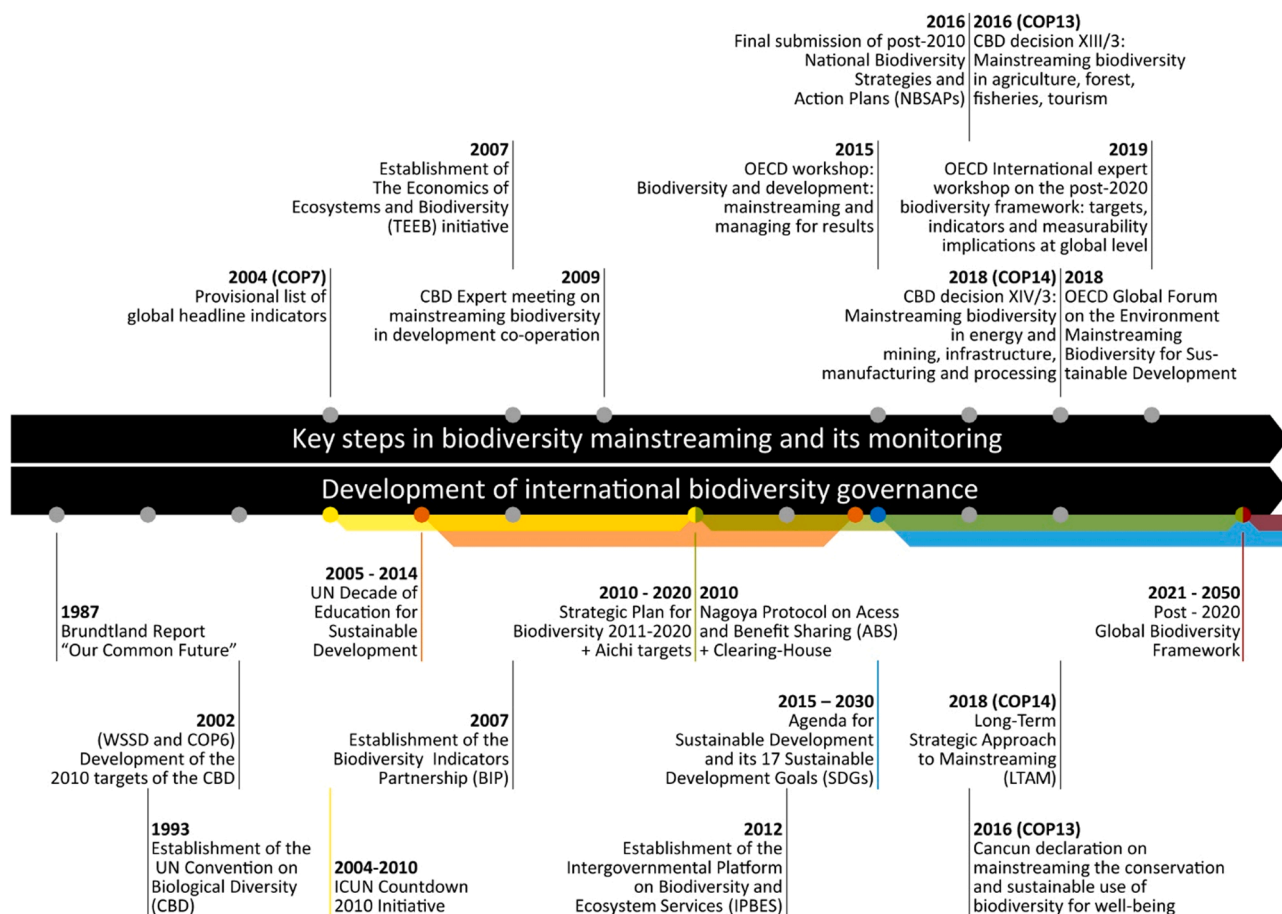


Fig. 1. Overview of key moments in biodiversity mainstreaming in development cooperation. The timeline characterises important events in international biodiversity governance and key achievements in biodiversity mainstreaming and its monitoring.

Millennium Summit).

In 2020 the CBD Strategic Plan for Biodiversity 2011–2020 expired, which demanded the revision of the Aichi targets and the drafting of a new framework. As a result of the COVID-19 crisis the new Post-2020 Global Biodiversity Framework will be adopted belatedly during the second part of 15th meeting of the Conference of Parties (COP) to the CBD, in 2022 in Kunming, China. The Global Biodiversity Framework will outline responsibilities for transformative actions, sustainable development and biodiversity conservation in order to work towards the 2050 Vision of ‘Living in harmony with nature’ (CBD, 2010; Milner-Gulland et al., 2021). On this occasion, biodiversity mainstreaming strategies of bilateral and multilateral aid providers in development cooperation will need to be assessed, updated and improved (OECD, 2019).

Monitoring mainstreaming is key in order to better understand and improve biodiversity mainstreaming. The upcoming 2022 Global Biodiversity Framework provides new momentum for the biodiversity mainstreaming agenda in development cooperation.

It is within this particular context that this study aims to contribute to a better understanding of the monitoring of biodiversity mainstreaming in development cooperation by development sector professionals, shedding light on the expected impact of the upcoming Post-2020 Global Biodiversity Framework. Specifically, this study aims to:

- characterise biodiversity mainstreaming monitoring as seen by aid providers;
- identify challenges associated with biodiversity mainstreaming and its monitoring;
- identify the influence of international governance dynamics on the biodiversity mainstreaming approaches of aid providers.

2. Materials and methods

2.1. The Delphi method

We used the Delphi method to gather expert information on biodiversity mainstreaming among aid providers. The Delphi method is an iterative survey method including controlled feedback step(s) that allows participants to reflect and react upon the responses of other respondents anonymously. The Delphi method facilitates the identification of consensus, allows to gather information from a select group of experts, and harnesses the power of collective reflection while simultaneously decreasing biases typically associated with live group discussions (Mukherjee et al., 2015).

The Delphi study consisted of two survey rounds: survey round 1 (S1) and survey round 2 (S2). Both surveys were administrated through Microsoft Forms (see Appendix A).

The questions of S1 were based on recent literature on biodiversity mainstreaming in development cooperation and preparatory documents for the Post-2020 Global Biodiversity Framework (Drutschinin et al., 2015; OECD, 2018; OECD, 2019; CBD, 2020). We provided the respondents with a general definition of biodiversity mainstreaming *sensu* Whitehorn et al. (2019). The questions probed for (1) the professional background of the respondent; (2) monitoring of biodiversity mainstreaming and; (3) strategies with respect to international biodiversity governance dynamics. An introduction to each topic and definition of the concept of mainstreaming and its monitoring was given ahead of each section.

S1 was semi-structured with closed, semi-open and open questions. The latter maximises the generation of new information and perspectives (Mukherjee et al., 2015).

S2 provided the opportunity for deepening questions which were designed in alignment with comments and contributions of respondents from S1 (Ratsimbazafy et al., 2019).

Questions on which respondents reached consensus (see 2.3. Data analysis) in S1 and primarily informative questions, were not repeated

in S2.

In both survey rounds, open questions and *other* options for multiple-choice answers gave respondents the possibility to comment, explain their position and propose additional information.

2.2. Selection of respondents

Firstly, we purposefully sampled respondents by identifying knowledgeable persons in the field of biodiversity mainstreaming in development cooperation (Palinkas et al., 2016). We contacted development cooperation agencies of all European OECD member states and departments implementing development cooperation actions of European OECD member countries in a systematic approach, requesting contact details of their staff involved in biodiversity mainstreaming.

Secondly, we identified international experts from participant lists of several events related to biodiversity mainstreaming in development cooperation (See Appendix B). In general, participants were selected based on their background with a national development agency, a multilateral or international organisation acting in the field of development or biodiversity mainstreaming, or an academic background in the field of biodiversity mainstreaming.

Thirdly, we applied the snowballing technique: all respondents were addressed to provide contact details of other experts with similar working scopes.

Following S1, a feedback report was prepared and sent to all respondents. This report contained the initial results of the first round, and an invitation to take part in the second round. The time frame given to respond was 10 weeks for the first round, and 4 weeks for the second round. Two reminders were sent to enhance participation for S1 (after four weeks) and S2 (after two weeks).

2.3. Data analysis

We analyzed the answers to closed and semi-open questions using descriptive statistics. Consensus was defined along a threshold of 75 % (> 75 % of the respondents selected the same answer = Consensus; < 25 % of the respondents selected the same answer = Dissensus) following Hugé et al. (2010) and Chu and Hwang (2008). If minimum 50 % of respondents selected the same answer it is referred to as a *majority*. The answers to open or semi-closed questions were used as an inspiration to design new questions for the second survey round.

We analyzed open questions using a qualitative three-stage coding process (Bryman, 2008; Rose et al., 2018) that has been adopted for qualitative analysis of open-ended answers in other Delphi studies (e.g. Hugé et al., 2020a). In this study, we built categories based on the respondents' statements. In a first step, codes were attached to the obtained data inspired by the statements of respondents, which were then merged into representative codes based on their similarity. Subsequently, final codes were generated to build key categories representing the context of the respondents' statements. For the complete three-stage coding process of the results presented in this paper see Appendix C.

For the analysis of the Likert-scale question, which measured the respondents' opinion on the representativity of the Rio markers on a scale from 1 to 5, consensus was defined by a mean score (\bar{x}) higher or equal to 3.5 and a quartile deviation (Q) below or equal to 0.5 following Chu and Hwang (2008). The answer was considered 'rejected' (dissensus) when its \bar{x} was below 3.5 and its Q above 0.5.

3. Results

3.1. Respondents' profile

A total of 34 respondents participated in S1 (round 1), while 12 respondents participated in S2 (round 2). These numbers fall within the range of respondents reported by Mukherjee et al. (2015), based on a review of 31 Delphi studies, of which 61 % had less than 20 respondents

for both rounds. Respondents can be divided into three major categories depending on their field of work. 41 % had a professional background with a national development agency or ministry, 32 % with an international or multilateral organisation and 18 % of the respondents were from an academic field of work (S1, Other: 9 %). The ratio stayed similar in S2 (national development agency/ ministry: 59 %, International/ multilateral organisation: 33% and academic: 8 %).

About half of the respondents have experience in biodiversity mainstreaming of more than 15 years, while about one third (36 %) work in the field between 5 and 15 years, only about one fifth (18 %) has been involved less than 5 years (S1). For S2 42 % of the respondents were involved in the field for more than 15 years, equally 42 % between 5 and 15 years and 17 % for less than 5 years.

21 % of the respondents rate the attention currently given to biodiversity mainstreaming in development cooperation *high*, while the rest considers it *moderate* (35 %) or *low* (44 %). None of the respondents chose the options *very high* or *not existent* (S1, Appendix D).

Among the respondents, sources used for collecting information on biodiversity (mainstreaming) are varied: consensus is only reached on the use of international policy and governance frameworks (used by 76 % of the respondents). More than two-thirds of the respondents also use scientific literature (71 %), information from other countries and agencies (71 %) or inform themselves by personal exchange with experts (74 %) or attend trainings, workshops and conferences (68 %). Agencies or ministry internal reports and other association's newsletters and publications are used by 56 % and 44 % of the respondents, respectively (S1).

3.2. Monitoring biodiversity mainstreaming

Mainstreaming actions are only monitored to a limited extent within development cooperation projects of the respondents' organisations. Only 24 % of the respondents confirm that biodiversity mainstreaming is consequently monitored within their organisation. 62 % report that it is monitored in some cases and 15 % do not monitor their biodiversity mainstreaming actions (Fig. 2).

In S1 experts were asked to list indicators they use to monitor biodiversity mainstreaming. Some respondents indicated frameworks from which they draw biodiversity mainstreaming indicators (e.g. the Sustainable Development Goals), others gave examples of specific indicators (e.g. *number of threatened species impacted*).

Ten respondents stated that they used the OECD DAC Rio markers for biodiversity (OECD, 2018). In general, use of specific, tailor-made indicator approaches is more frequent (45 %) than the use of existing standardised frameworks such as ecosystem-based assessments or national capital accounting (Fig. 3).

Responses refer to measures that address pressures on the state of

biodiversity and action towards related policies, e.g. by aid providers (OECD, 2019). Response indicators used for the monitoring of biodiversity mainstreaming can be classified into five types: *inputs* (e.g. finances), *processes* (e.g. establishment of inter-ministerial committees), *outputs* (e.g. national assessment, other studies), *outcomes* (e.g. new or more ambitious policies) and *impacts* (e.g. changes in the state of biodiversity and ecosystem services) (OECD, 2018). Only 12 % of the respondents stated that they monitor mainstreaming efforts across all types of responses. Consensus is only reached for the use of indicators that monitor *impacts*. Academics agree upon the use of indicators to monitor *outcomes* (80 %) and *impacts* (100 %). A majority of respondents from national development agencies/ ministries indicate that mainly *input* (57 %) and *impact* (67 %) indicators are used (Fig. 4).

A majority of S2 respondents are familiar with the Rio-methodology by the OECD DAC, while 36 % use them within their organisation (limited to respondents of national development agencies) (Fig. 3). Respondents of international and multilateral organisations are less familiar with the Rio markers. Three out of four respondents of international and multilateral organisations did not know the Rio-methodology.

The results (S2) indicate that respondents prefer a generalised (sub-set of indicators (67 %), that is applicable internationally and that ensures comparability. Supportive arguments (as a response to the open-ended questions) highlight comparability to ensure benchmarking and to promote a uniform approach in achieving global biodiversity targets. Others state that current strategies are based on a comparable set of indicators. Respondents who prefer specified indicators (17 %) argue that these have a greater relevance for local and national biodiversity policies and thus provide a better starting point for interventions.

The results indicate that respondents of national development agencies/ ministries preferably adopt indicators from the SDG framework. Among respondents of international/ multilateral organisations consensus is reached regarding the SDGs and the Aichi targets. In contrast respondents with an academic background tend to rely on indicators provided by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Fig. 5).

All respondents (S1, n = 27, National development agency/ ministry: n = 11, International/ multilateral organisation: n = 9, Academic: n = 5, Other: n = 2) state that monitoring results are used to improve future biodiversity mainstreaming strategies within their organisation. In general, for 59 % of the respondents, monitoring results are *rarely* used to improve strategies with respect to biodiversity mainstreaming, while 33 % stated *often*. International and multilateral aid providers integrate results more *often* (56 %) than bilateral aid providers (27 %). However, only two (8 %) respondents stated that their organisations *always* improve their strategies based on monitoring results.

73 % of respondents (S2, n = 11) are partly satisfied with the

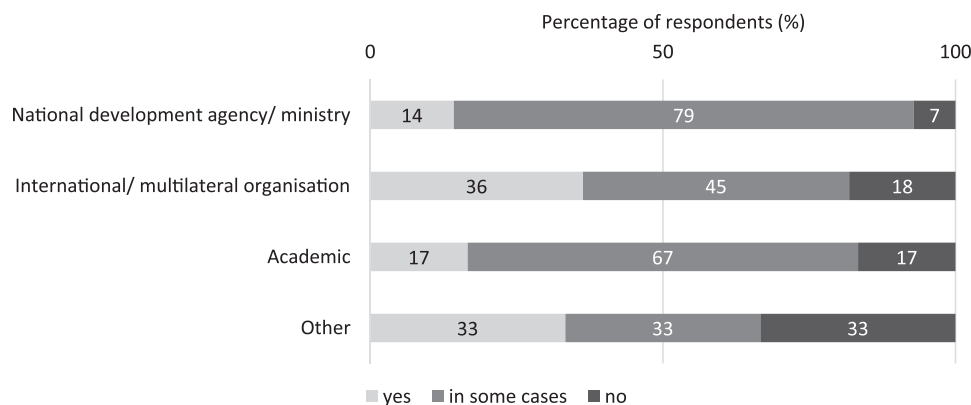


Fig. 2. Extent of monitoring biodiversity mainstreaming within the development cooperation projects of the respondent's organisation (S1). Numbers in bars indicate the percentage (%) of respondents selecting an answer.

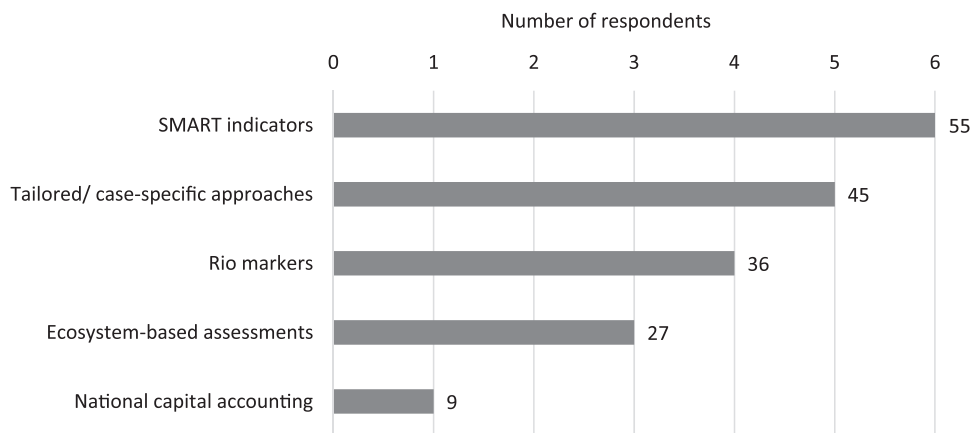


Fig. 3. Indicator frameworks and concepts used within the respondents' organisations (S2, n = 11 (National development agency/ ministry: n = 7, International/ multilateral organisation: n = 3, Academic: n = 1)). The percentage (%) of respondents selecting the answer is indicated behind the bars. SMART is an acronym reflecting ideal-typical qualities of indicators. It stands for 'specificity, measurability, achievability, relevancy and time-based' (Selvik et al., 2021).

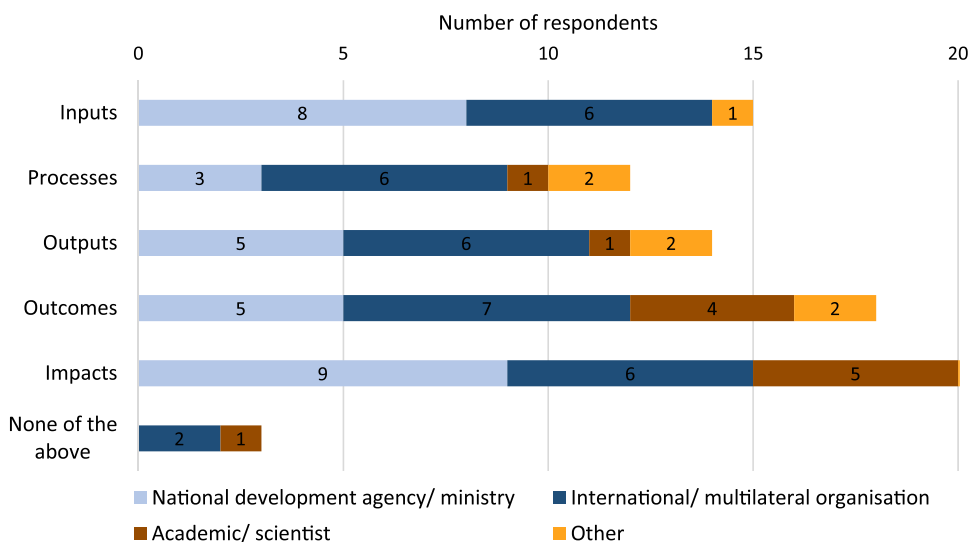


Fig. 4. Types of indicators used by respondents for monitoring (S1).

monitoring of indicators existing within their organisations. Only two respondents (18 %) state that they are fully satisfied with the indicators used, while one respondent is not satisfied.

Political will and commitment are seen as important requirements for effective biodiversity mainstreaming by the respondents. Additionally, respondents state that an increased awareness and knowledge on biodiversity mainstreaming is important to achieve effective mainstreaming (67 %), followed by the existence of good baseline data (58 %) (Fig. 6).

A qualitative analysis shows that improvements of the current application of indicators are desired with respect to four major topics (Table 1). The respondents' statements reflect that the topics require both fine-scale improvements (e.g. improve internal reporting) as well as broad, structural changes (e.g. increased use of monitoring results in decision-making).

3.2.1. Biodiversity databases and initiatives

Respondents (S1) state that they are familiar with biodiversity databases in general (82 %). Only 18 % of the respondents do not know any databases.

Consensus is reached regarding the actual use of the IUCN Red List (97 %), followed by the Global Biodiversity Information Facility (GBIF) (66 %) and the Clearing-House Mechanism (CHM) of the CBD (41 %)

(Fig. 7).

3.3. Challenges to biodiversity mainstreaming and its monitoring in development cooperation

There was no single main challenge to biodiversity mainstreaming that was identified as consensual (meaning that none of the challenges was selected by a minimum of 75 % of the respondents) (Table 2). The lack of political will, short term economic benefit, insufficient understanding of links between poverty and biodiversity, and misreading local contexts are proposed as other (additional) challenges to monitoring biodiversity mainstreaming (in response to the open-ended question).

3.3.1. Biodiversity mainstreaming and other cross-cutting themes

We investigated in which way common cross-cutting themes relate with biodiversity mainstreaming in development cooperation projects, and what other topics are perceived as cross-cutting issues. Opinions are diverging and no 75 % consensus is reached on neither synergies nor trade-offs. A majority acknowledges that 'Water' and 'Education' share synergies with biodiversity mainstreaming. There is general dissensus among respondents about trade-offs being the only interaction of the presented cross-cutting themes with biodiversity mainstreaming. *Health* is mentioned as a more general additional topic. A majority of the

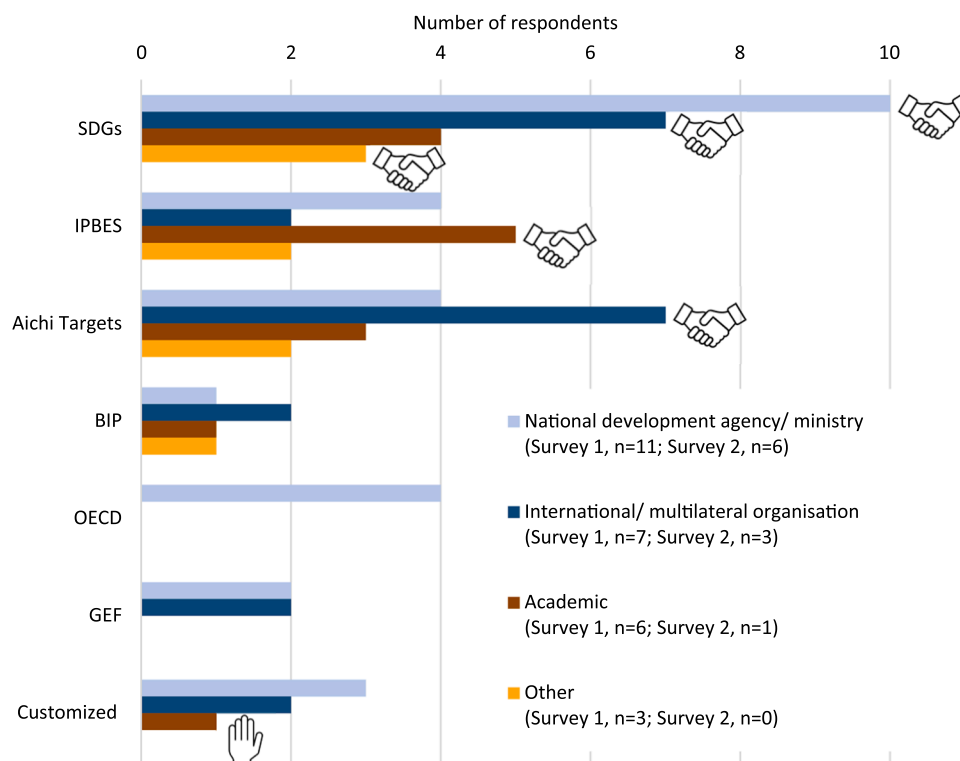


Fig. 5. Sources for indicators for monitoring biodiversity mainstreaming. The results for the options SDGs, IPBES, Aichi Targets and BIP (Biodiversity Indicators Partnership) originate from S1 (n = 27), the results for the options OECD, GEF and Customised from S2 (n = 10). Hand-shaking symbol = consensus reached, raised hand = no consensus reached, no hand symbol indicates that neither consensus nor dissensus were reached.

respondents agree on both trade-offs and synergies between biodiversity mainstreaming and *Technology, Governance and Climate* (Fig. 8).

3.4. Influence of international biodiversity governance dynamics on biodiversity mainstreaming in development cooperation

3.4.1. Influence of international biodiversity governance on bilateral mainstreaming strategies

All respondents (S1) show awareness of the SDGs. Consensus in awareness is also reached for the governance framework of the CBD (94 %) in general and associated frameworks, including the Aichi targets (79 %) and the Post-2020 Global Biodiversity Framework (76 %), as well as for the IPBES (88 %).

We further investigated in which ways international biodiversity governance influences bilateral aid providers (Table 3).

3.4.2. The Post-2020 Global Biodiversity Framework – expected responses of aid providers

62 % of the respondents (S1) state that the Post-2020 Global Biodiversity Framework will result in a revision and change of biodiversity mainstreaming strategies of bilateral aid providers (Fig. 9).

The results (S2, n = 10) indicate that the Post-2020 Global Biodiversity Framework will have a promoting effect on biodiversity mainstreaming in development cooperation (60 %). In contrast, none of the respondents state that it will overburden development agencies. However, critics include that the framework will remain a theoretical strategy (20%) and that other priorities will predominate biodiversity strategies (40 %).

4. Discussion

4.1. Assessing progress towards biodiversity mainstreaming

4.1.1. Indicator frameworks – the heart of monitoring

Our results are in line with previous studies (Drutschinin et al., 2015; Janoušková et al., 2018) as we found that current monitoring practices remain insufficient to effectively measure progress towards biodiversity mainstreaming. The OECD highlights the development of strategies to measure progress towards biodiversity mainstreaming over time, however monitoring of biodiversity mainstreaming is still in its infancy (OECD, 2018). Specific, tailor-made indicators are commonly applied by the respondents. This might be closely linked to the practicability of indicator frameworks (cf. Section 4.1.3) as well as to the absence of a uniform approach.

A limited number of peer-reviewed publications focus on monitoring of biodiversity mainstreaming in development cooperation (e.g. Adams et al., 2004; Tittensor et al., 2014; Hugé et al., 2017; Roos et al., 2020) and results of biodiversity mainstreaming practices are rarely shared through formal scientific (peer-reviewed) channels (Redford et al., 2015). Most information on the current state of monitoring biodiversity mainstreaming is accessible through publications of intergovernmental organisations such as the OECD or GEF (Global Environment Facility) (e.g. Huntley and Redford, 2014; Drutschinin et al., 2015). Sparse research on indicators to monitor biodiversity mainstreaming results in a lack of scientific knowledge on the effectiveness of indicators and might lead to insecurities in their application. This is closely linked to the gap of monitoring capacity building for monitoring biodiversity mainstreaming in development cooperation (Mcowen et al., 2016). Based on the challenges experienced by the respondents clearly communicated and defined methods as well as training technical expertise could be a starting point for improvements.

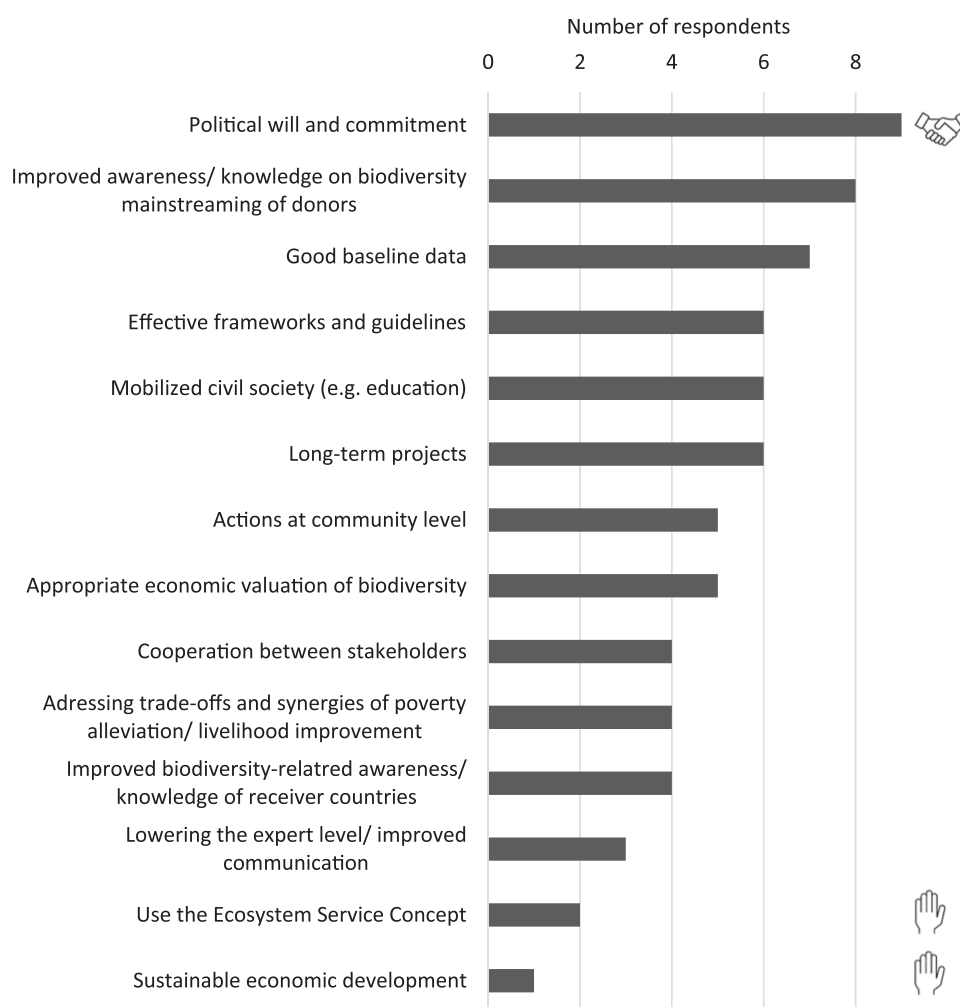


Fig. 6. Positive requirements for effective biodiversity mainstreaming identified based on past experiences within the respondents' organisations (S2). Hand-shaking symbol = consensus reached, raised hand = dissensus reached. No hand = neither consensus nor dissensus was reached.

Table 1

Topics related to the current application of indicators that require improvement according to the respondents (S2, n = 9). Coding method adapted from Rose et al. (2018).

| Topics | Number (and percentage (%)) of respondents mentioning the topic as a potential improvement |
|--|--|
| Interpretation of the complexity of biodiversity loss and management of related data | 4 (44) |
| Scientifically sound and stable indicators | 3 (33) |
| Mainstreaming strategies and cooperation at all levels of biodiversity mainstreaming | 4 (44) |
| Improved capacity building and education | 2 (22) |

4.1.2. Spoiled for choice?

There is a huge diversity of indicators to monitor biodiversity mainstreaming (OECD, 2018). Nevertheless, various relevant indicator frameworks and initiatives are emerging (e.g. SDGs indicators list; GEF-7 core indicators and sub-indicators) to monitor progress towards biodiversity mainstreaming. Despite the existing efforts supporting indicator development, we found that satisfaction with current existing indicators within the respondents' organisations is moderate and that respondents are challenged by poorly defined monitoring methods. A lack of coordination of biodiversity mainstreaming monitoring might

contribute to a poor uptake of indicators. Adequate capacity building offers solutions to bridge the science-policy gap and thus enhance effective biodiversity mainstreaming (Vanhove et al., 2017).

Our results indicate that bilateral and multilateral aid providers rely on SDG indicators. This highlights the need to address the linkages between – all – SDGs and the Post-2020 Global Biodiversity Framework together (as also suggested by OECD, 2019). We propose to organise indicators under different policy frameworks more efficiently. Aligning the biodiversity mainstreaming indicators used in different global frameworks would contribute to address the challenge of '*too many [existing] parallel agendas and workflows*', as quoted by one respondent.

Ideally, a (sub-)set of indicators, measurable and comparable across countries, could offer a solution to ease the application and management of indicators (OECD, 2019). Respondents of national development agencies and ministries clearly prefer the use of headline indicators (a fixed set of high-level indicators that can be used to track and communicate progress towards the overall biodiversity mainstreaming targets). These would in theory provide an indicator framework for consistent and comparable data collection, which is however not understood as a uniform concept yet by the respondents. Preparation for the Post-2020 Global Biodiversity Framework discusses the adoption of such a consistent and quantitative (sub-)set of headline indicators, which are comparable internationally and easy and inexpensive to collect (OECD, 2018, 2019). An equal approach is highlighted with respect to communicating progress towards the SDGs (Janoušková et al., 2018). From our perspective, such headline indicators ideally need to be

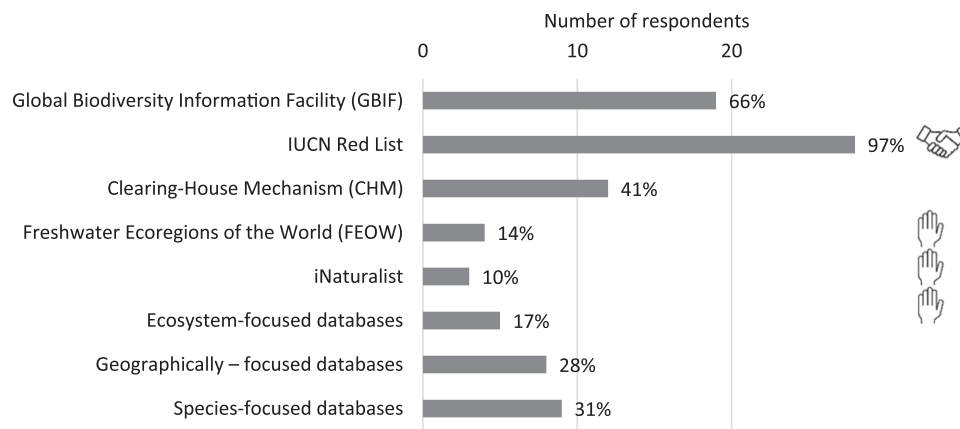


Fig. 7. Biodiversity databases and initiatives used for monitoring biodiversity mainstreaming (S1, n = 29). Percentage of respondents is indicated behind the bars. Hand shaking symbol = consensus reached; Raised hand = dissensus reached. No hand symbol = neither consensus nor dissensus reached.

Table 2

Respondents' agreement with challenges experienced with respect to monitoring biodiversity mainstreaming in development cooperation (S1). (The listed challenges were based on literature by Davies et al., 2014, OECD, 2015 & Drutschinin et al., 2015). Hand shaking symbol = consensus; Raised hand = dissensus. No hand symbol = neither consensus nor dissensus reached.

| Challenges experiences with respect to monitoring biodiversity mainstreaming | Percentage of agreement (%) | Consensus/dissensus reached among respondents of |
|--|-----------------------------|---|
| Lack of data to set baselines and targets for biodiversity mainstreaming | 50 | |
| Complexity and causes of biodiversity loss | 50 | |
| Lack of coordination between project levels | 47 | |
| Lack of technical expertise on biodiversity | 44 | Others |
| No clearly defined methods | 38 | |
| Lack of personal capacities | 35 | international/multilateral organisations |
| Lack of financial resources | 32 | national development agencies/ ministries others |
| Lack of communication between social and ecological sciences | 29 | national development agencies/ ministries |
| Governmental situation in receiver country | 29 | national development agencies/ ministries and academics |
| Cheating/ corruption/ illegal interventions | 12 | national development agencies/ ministries; international/multilateral organisations and academics |
| Cross-border/ cross-ecosystem effects | 0 | all |

aligned with development objectives to be effectively applied within development cooperation contexts.

Another frequently used alternative by respondents is to customise indicators. This often demands more capacities and technical knowledge and reflects the lack of a conceptual framework for monitoring biodiversity mainstreaming in development cooperation (Hák et al., 2016).

4.1.3. Criticisms of an established indicator approach

The OECD DAC Rio marker methodology is a monitoring tool for bilateral aid providers to mark biodiversity-related development finance. The Rio markers are internationally comparable, quantitative and according to our results commonly used by aid providers. Although they helped to track a significant growth in mobilised biodiversity finance internationally (OECD, 2018), the indicator is not approved as representative by respondents in terms of monitoring biodiversity mainstreaming efforts. When asked for improvements, multiple respondents stated that a major weakness of *Rio marker 1*¹ is that it inadequately quantifies the proportion of biodiversity funding. Additionally, it remains a marker for classifying the proportion of biodiversity funding in Official Development Assistance (ODA) and makes no statement about the qualitative impact of biodiversity mainstreaming interventions.

Although the Rio markers are a multilaterally developed tool, respondents of multilateral organisations were interestingly not familiar with the Rio markers. This may reflect the perceived inadequacy of the Rio markers, which only consider direct spending (counted as 100 % spending) and indirect spending (counted as 40 %), thereby failing to acknowledge the contributions made by indirect expenditures in a controlled and proportionate way (Rachel et al., 2021).

4.2. Addressing challenges in monitoring biodiversity mainstreaming

4.2.1. Biodiversity mainstreaming as a prerequisite for monitoring

The respondents' assessments show a general awareness of biodiversity mainstreaming in development cooperation, as well as an acknowledgement of the need to improve biodiversity mainstreaming. This snapshot of biodiversity mainstreaming in development cooperation shows that despite increasing awareness and efforts documented by scientists and intergovernmental institutions (Drutschinin et al., 2015; Hugé et al., 2020b) effective mainstreaming of biodiversity in development cooperation remains suboptimal. This is related to the inherent complexity of cross-sectoral action, and to insufficient co-ordination between different levels (national, regional, project level) as well as to a lack of technical expertise on biodiversity mainstreaming (cf. Table 2). Inadequate mainstreaming of biodiversity in development cooperation thus complicates monitoring and evaluation of progress.

Although biodiversity monitoring as such has been integrated in – at least some – development initiatives since the 1990's, challenges remain in tracking progress towards biodiversity mainstreaming (Huntley and Redford, 2014; Drutschinin et al., 2015; IPBES, 2019a).

¹ marks an activity as *significant*: Biodiversity-related concerns are formulated as an objective but are not the primary objective of an activity (OECD, 2018).

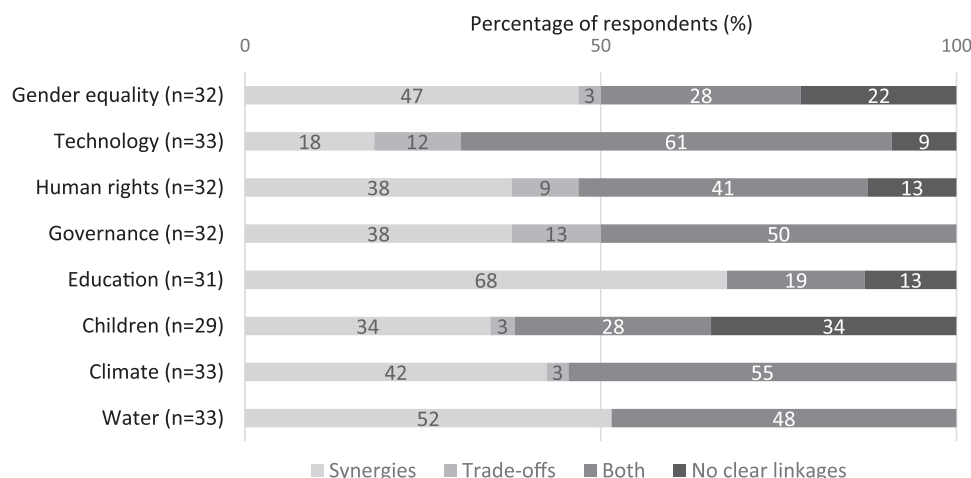


Fig. 8. Linkages of biodiversity mainstreaming with other cross-cutting themes in development cooperation (S1). Percentage (%) of respondents selecting the answer indicated within bars. See Appendix D (Table IV) for additional cross-cutting themes that interact with biodiversity mainstreaming.

Table 3

Influence of international biodiversity governance dynamics on the work of bilateral aid providers (S1). Hand shaking symbol = consensus; Raised hand = dissensus. No hand symbol = neither consensus nor dissensus reached.

| Attributes of international biodiversity governance | Percentage of respondents selecting the answer (%) | Consensus/Dissensus |
|--|--|---------------------|
| Increase synergies between bilateral aid providers (harmonisation) | 53 | |
| Enhance competition in the field of biodiversity mainstreaming | 12 | ✋ |
| Inform about biodiversity mainstreaming | 71 | |
| Help to set priorities | 82 | 🤝 |
| Help to set indicators for monitoring | 50 | |
| Increase accountability | 59 | |
| Other | 9 | |

The respondents' statements revealed the need to integrate monitoring results more frequently in biodiversity mainstreaming strategies to target challenges.

Despite a commonly acknowledged biodiversity funding gap (Waldron et al., 2017), a lack of financial resources for implementing monitoring strategies (cf. Davies et al., 2014) is not highlighted as a challenge by respondents of bilateral aid providers.

4.2.2. Baselines for monitoring biodiversity mainstreaming

Setting baselines for monitoring biodiversity is key, as indicated by the respondents with respect to monitoring biodiversity mainstreaming in development cooperation. General views on the Post-2020 Global Biodiversity Framework highlight the importance of coherent and measurable targets (CBD, 2018). As biodiversity indicators depend on data collected over long time frames (Scholes et al., 2008), the OECD and Biodiversity Indicators Partnership (BIP) advise to build on existing multi-country datasets to assure progress towards the targets can be tracked (CBD, 2018; OECD, 2019). The majority of respondents experiences a lack of data to set baselines and targets for biodiversity as a challenge to effective monitoring. Inadequate biodiversity data coverage, availability and management are reported as a common barrier in effectively monitoring biodiversity (Mihoub et al., 2017; Rochette et al., 2019). IPBES and the Global Biodiversity Information Facility (GBIF) make continuous improvements to the existing set of global and national biodiversity indicators and provide and manage suitable data

(Kins et al., 2009; Díaz et al., 2015; Elliott et al., 2020).

This study's respondents indicate that the IUCN Red List is the most used biodiversity database among aid providers. Red List Indices² are also being promoted as global indicators for tracking progress towards the targets of both the CBD and the SDGs (Butchart et al., 2005; cf. Goal 15.5 (IAEG-SDGs, 2020)).

Although attribution remains challenging, biodiversity mainstreaming's ultimate effectiveness will eventually be reflected in improved biodiversity metrics.

4.2.3. The complexity of biodiversity loss

Additionally, a majority of respondents state that the complexity and causes of biodiversity loss and the long timeframes with respect to visible results challenge monitoring within their institutions.

The complexity of biodiversity is closely linked to technical issues in assessing biodiversity (Brummitt et al., 2017), which is a missing expertise acknowledged by the respondents (cf. Table 2). An additional aspect that complicates the monitoring of the effectiveness of mainstreaming biodiversity is that biodiversity impacts cannot be measured by way of a single quantitative unit (contrary to climate change impacts which can all be converted to CO₂ equivalents (tCO₂e)) (OECD, 2019; Vačkář et al., 2012; Zaccai and Adams, 2012). Instead, assessing biodiversity and its loss requires a vast range of measures because of its inherent complexity (cf. Article 2, CBD, 1992) and the multiple scales at which biodiversity can be measured. The rise of climate change (mitigation, but increasingly also adaptation) to policy prominence offers the opportunity to realise synergies (win-win situations) (Runhaar et al., 2018), yet also risks overshadowing biodiversity concerns in times when global challenges compete for public and policy attention (Zaccai and Adams, 2012). This is also reflected in the diversity of opinions among our study's respondents regarding trade-offs or synergies between climate change and biodiversity mainstreaming.

4.2.4. Other cross-cutting themes

Fostering synergies between biodiversity and other cross-cutting themes is cost-effective and beneficial in achieving sustainable development, given its multi-dimensional and integrative nature (Waas et al., 2011) as reflected for example by the SDGs. The majority of respondents highlighted education as an important cross-cutting theme to address together with biodiversity mainstreaming. The promotion of

² The Red List Index (RLI) bases on the IUCN Red List of threatened species and is an indicator for trends in overall extinction risk for species (IUCN Red List, n.d.).

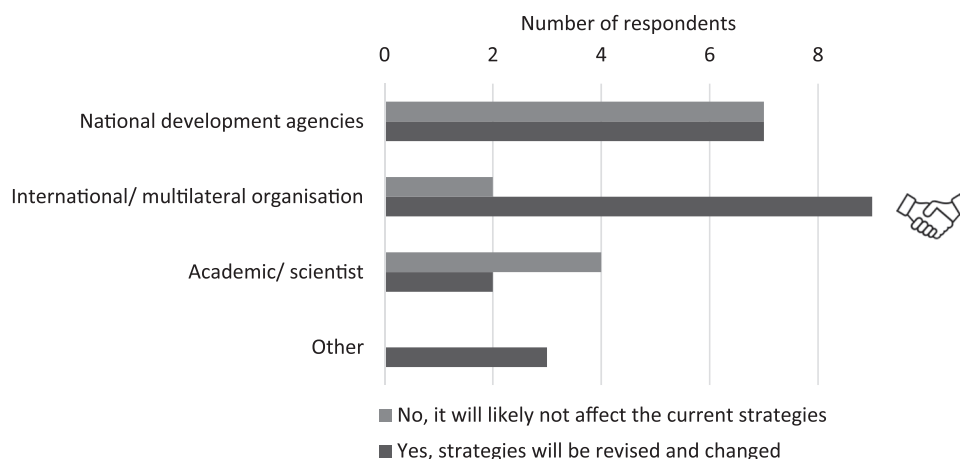


Fig. 9. Expected reaction of bilateral aid providers with respect to the Post-2020 Global Biodiversity Framework (S1). Hand shaking symbol = consensus reached. No hand shaking symbol = neither consensus nor dissensus reached.

biodiversity conservation through biodiversity education is documented in several case studies (e.g. [Ramadoss and Poyyamoli, 2011](#); [Phanith and Sothun, 2014](#)). Further, ‘water’ was mentioned by most of the respondents as a cross-cutting theme linked to biodiversity mainstreaming. Integrated water management and biodiversity conservation are, for example, jointly addressed by the CBD to within a broader sustainable development agenda ([SCBD, 2015](#)). Despite existing efforts, an urgent need remains to improve knowledge on synergies between cross-cutting themes to maximise co-benefits in mainstreaming and better align targets and indicators of international biodiversity governance ([Drutschinin et al., 2015](#)). This need was recently taken up by the [IPBES \(2019b\)](#) by highlighting the importance of cross-cutting issues (gender, indigenous & local knowledge, and climate change) in reaching biodiversity conservation targets.

4.3. Biodiversity mainstreaming in development cooperation post-2020

Our study confirms that international policy and governance frameworks are used as a key source of biodiversity-related information and an orientation for biodiversity mainstreaming by the respondents. Orientation along international biodiversity governance frameworks is also highlighted in the policy strategies of international and multilateral organisations (e.g. [The World Bank](#)) as well as in national development agencies (e.g. [Sida, 2019](#)). Additionally, political will and commitment are rated as important for effective mainstreaming by respondents. Political will and commitment are linked to a more efficient and streamlined science-policy-development interface. This interface is often hampered by systemic and institutional bottlenecks, preventing an efficient uptake by Official Development Aid of mainstreaming procedures and its monitoring through good indicators. Bringing together scientists and authorities to facilitate transfer of scientific knowledge and mutual capacity building within a Monitoring-Reporting-Verification (MRV) concept is a good way forward to help alleviate this barrier ([Vanhove et al., 2017](#); [Rochette et al., 2019](#)).

While new policies and strategies will build on the CBD Strategic Plan for Biodiversity 2010–2020, contributors to the new framework advocate for greater simplicity in language and structure ([OECD, 2019](#)).

However, according to the respondents, lesser challenges hampering biodiversity mainstreaming are encountered at international level. Incidentally, the commitment of national governments (through their National Biodiversity Strategies and Action Plans (NBSAPs)) plays an important role for mainstreaming biodiversity ([Whitehorn et al., 2019](#)). As pointed out by the respondents, an inclusive perspective and the improvement of cooperation between stakeholders at different levels of governance could help to overcome challenges in mainstreaming

biodiversity ([Karlsson-Vinkhuyzen et al., 2018](#)).

Nevertheless, it remains to be seen, if the post-2020 Global Biodiversity Framework will be impacted negatively by other – seemingly competing – policy priorities (e.g. climate change ([Hugé et al., 2020a](#))), as expected by 20 % of the respondents.

The respondents assess international biodiversity governance dynamics as a help to set priorities for mainstreaming and increase harmonisation between aid providers, which supports enhanced consistency of tracking progress towards biodiversity targets as intended by the post-2020 Global Biodiversity Framework. Comparability of biodiversity mainstreaming might be promoted by alignment of bilateral aid providers, which has been experienced as an influence of international biodiversity governance dynamics by a majority of respondents in the past. Despite the positive hopes in the guidance of the Post-2020 Global Biodiversity Framework, only half of the respondents think it will help to set indicators for monitoring. These reservations might be linked to past experiences in monitoring and poor alignment of indicators with biodiversity targets as stated by the Biodiversity Indicators Partnership (BIP) ([CBD, 2018](#)).

Our findings showed that not all response indicators receive the same attention across aid providers and impacts indicators being prioritised. Impact indicators are often prioritised as they are often directly indicating the relationship between human pressures and biodiversity ([Vackár et al., 2012](#)).

4.4. Limitations of the current study

The online application of the Delphi has been effective to collect information and opinions from experts across physical distance and reduce time in conducting a Delphi survey (cf. [Gnatzy et al., 2011](#); [Benitez-Capistros et al., 2014](#)). However, the Delphi survey did suffer from a high attrition rate between rounds and low response rate, despite a broad target group. These drawbacks are recurrent challenges of the method ([Mukherjee et al., 2018](#)) and have been acknowledged in other environmental and social Delphi studies (e.g. [Jönsson et al., 2016](#)). As these weaknesses possibly limit the findings of the study ([Mukherjee et al., 2015](#)) the reader should interpret the study as a representative exploration of opinions rather than a comprehensive overview of provider strategies with respect to monitoring biodiversity mainstreaming. In the future, conducting a Delphi within the frame of an official workshop on monitoring biodiversity mainstreaming in development cooperation could provide further insights.

5. Conclusion

We found that biodiversity mainstreaming monitoring efforts by

development cooperation (aid) providers are still uneven and lack consistency. The lack of integration of biodiversity monitoring in future development cooperation initiatives remains a hurdle in effective biodiversity mainstreaming, as trends in biodiversity metrics are key to learn about the ultimate effectiveness of biodiversity mainstreaming efforts.

Despite the laudable efforts of the international community to create a robust indicator framework to measure progress towards biodiversity targets, clearly defined methods and improvement of biodiversity mainstreaming monitoring strategies of aid providers are still needed. Indicator development and management remains a challenge, therefore we advocate the improvement and better communication of existing frameworks, and a better streamlining of the science-policy-development interface, which could help bilateral aid providers to monitor biodiversity mainstreaming more effectively and in an atmosphere of mutual learning and benchmarking.

Our study revealed that aid providers orient themselves towards international biodiversity governance frameworks with respect to biodiversity mainstreaming and monitoring strategies. While the Covid-19 crisis has impacted progress towards negotiations for the Post-2020 Global Biodiversity Framework, it may simultaneously have increased the urgency to address biodiversity loss (Schmeller et al., 2020).

The post-2020 Global Biodiversity Framework is expected to influence biodiversity mainstreaming strategies of Official Development Assistance (ODA) providers. As it targets important challenges regarding monitoring biodiversity mainstreaming, we conclude that the indicator ambitions under the Post-2020 Global Biodiversity Framework have the potential to improve strategies of aid providers. For enhanced consistency and comparability in the use of indicators for monitoring, our findings indicate that a set of headline indicators could support – and even contribute to coordinate – monitoring actions of aid providers.

With respect to effective biodiversity mainstreaming strategies, we suggest further research on how biodiversity mainstreaming indicators could be better connected under existing frameworks and communicated and more effectively applied in development cooperation.

CRediT authorship contribution statement

Charlotte Broerken: Conceptualization, Investigation, Methodology, Writing – original draft and revision. **Jean Hugé:** Conceptualization, Supervision, Investigation, Methodology, Writing – original draft and revisions. **Farid Dahdouh-Guebas:** Supervision, Resources. **Tom Waas:** Methodology. **Anne-Julie Rochette:** Methodology. **Luc Janssens de Bisthoven:** Methodology, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.envsci.2022.05.017](https://doi.org/10.1016/j.envsci.2022.05.017).

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