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Assessing coverage of the monitoring framework of the Kunming-Montreal Global Biodiversity Framework and opportunities to fill gaps

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The Kunming-Montreal Global Biodiversity Framework (GBF) is the most ambitious multilateral agreement on biodiversity to date. It calls for a whole-of-government and whole-of-society approach to halt and reverse biodiversity loss worldwide. The GBF's monitoring framework lays out how Parties to the Convention on Biological Diversity are expected to report on their progress. An expert group convened by the Convention on Biological Diversity, the Ad Hoc Technical Expert Group (AHTEG) on Indicators, provided guidance on its implementation, including a gap analysis to identify the strengths and limitations of the indicators in the monitoring framework. We present the results of the AHTEG gap analysis and provide recommendations on implementing and improving monitoring of the GBF. We compare three implementation scenarios, from worst-case to best-case: (1) Parties only report on required headline and binary indicators; (2) Parties also report on all headline indicator disaggregations and (3) Parties additionally report on all optional component and complementary indicators. In each case, the monitoring framework covers (1) between 19–40%, (2) 22–41% and (3) 29–47% of the elements in the GBF's goals and targets. Even in the best-case scenario (3), no indicators are available for 12% of the GBF's elements. In practice, the coverage and thus effectiveness of the monitoring framework will depend on which indicators (required and optional) and disaggregations countries apply. Substantial investment is required to collect the necessary data to compute indicators, infer change and effectively monitor progress. We highlight important next steps to progressively improve the efficacy of the monitoring framework.

Since the Convention on Biological Diversity (CBD) was opened for signature in 1992 (ref. 1), three sequential decadal plans have been adopted to address the alarming rate of biodiversity loss worldwide[2]. The targets for 2010 and 2020 were largely unmet[3–5]. The latest plan, the Kunming-Montreal Global Biodiversity Framework (GBF), adopted in 2022, is the most ambitious to date[6]. The GBF hinges on a 2050 vision of living in harmony with nature, to be realized through commitments towards four goals by 2050 and 23 action-oriented targets by 2030[6]. The GBF is built around a theory of change (Fig. 1) that aims to tackle the drivers of biodiversity loss, recognizing that urgent, transformative and widespread action is required across all sectors of society to halt and reverse biodiversity loss.

The GBF includes a monitoring framework (Box 1), an important innovation guiding countries on how to report their progress towards the goals and targets (Fig. 1). The monitoring framework sets out how Parties to the Convention are expected to record their efforts and

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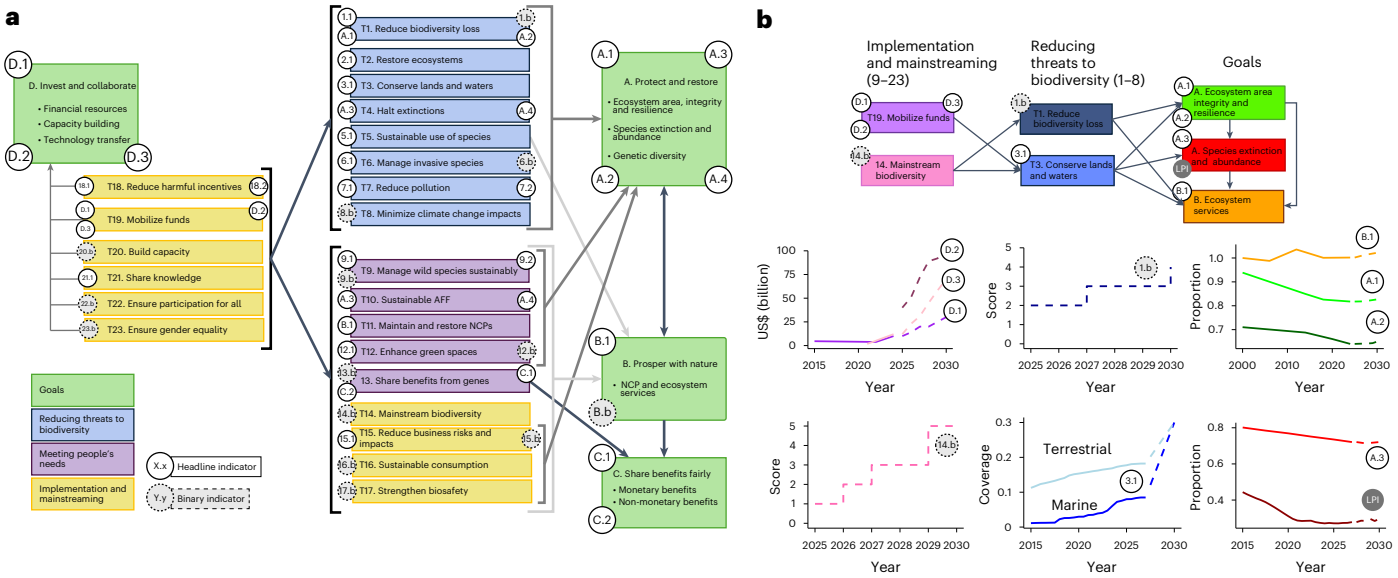

Fig. 1 | The GBF theory of change organized using goals and targets with their required indicators. a, The GBF divides its targets into three categories: reducing threats to biodiversity (targets 1–8); meeting people's needs (targets 9–13); and implementation and mainstreaming (targets 14–23), which are needed to deliver on its ambition and achieve the four goals. All of them have at least one required indicator (headline, binary or both, shown in circles) to track progress; some of them are related. Implementation of the targets by 2030 contributes to achieving the goals and other linked targets in the GBF. The indicators in the monitoring framework are designed to help track progress along all aspects of the GBF. **b**, A partial theory of change for some targets (1, 3, 14 and 19) and goals (A and B) of the GBF, with associated indicators, showing how mainstreaming and investment can increase protection and conservation, leading to the goals for species, ecosystems and ecosystem services. Reporting systematically on the required indicators will allow progress to be tracked nationally and globally on each goal and target, enabling action to be taken as needed to deliver on the overall theory of change. Parties may also choose to report on optional indicators (for example, the LPI). Quantitative headline and component indicators can track yearly changes while binary indicators are reported with every national report. Where past data are available, graphs show solid lines. The dashed lines represent optimistic predictions of a world where goals and targets are met. Indicators that are new are shown only with dashed lines because no past data are available to estimate them. AFF, agriculture, forestry and fisheries; LPI, Living Planet Index.

progress using a set of consistent indicators compiled at the national level[7,8], while allowing some flexibility because of differing capacity and data availability across Parties[9]. The monitoring framework was established to improve transparency and accountability among Parties[10], recognizing that failure to reach past targets has been linked to low levels of implementation[11] and difficulties in tracking progress[12]. Parties are requested to use the monitoring framework in future national reports to the CBD, including the next (seventh) national report due in February 2026, ahead of the 17th meeting of the Conference of the Parties (COP17).

There is now a need for the scientific community and relevant actors to support countries with the design and implementation of their domestic monitoring frameworks, including how monitoring programmes can gather the data needed for indicator updates[13]. The effectiveness of the GBF's monitoring framework depends on three key aspects: (1) how well its indicators cover the scope of the GBF's goals and targets; (2) national uptake of the monitoring framework as a driver for improving national monitoring systems; and (3) the dissemination and sharing of data and metadata on the indicators of the monitoring framework. This Analysis addresses the first of these aspects.

The early process of designing the GBF's monitoring framework occurred alongside the negotiation of the GBF text and focused on selecting indicators from available lists, such as the Sustainable Development Goal (SDG) indicators[14] and those generated by members of the Biodiversity Indicators Partnership. This resulted in a list of indicators at several stages of development that was then categorized and matched with relevant goals and targets. The selection process called for at least one headline indicator (Box 1) per goal and target. Where possible, headline indicators were assigned to quantitatively assess progress towards the main intent of the goal or target. Headline indicators were intended to include a small list of indicators to capture the overall scope of a goal or target. This post hoc process resulted in some targets and goals lacking headline indicators. Binary indicators (Box 1) were developed to qualitatively assess progress towards a goal or target (for example, does a legislative framework exist to address the aims of a target?). Where existing indicators were deemed useful for covering a single aspect of a goal or a target, but less relevant for covering its full scope, these were assigned to the optional component or complementary indicator list (Box 1) to allow Parties wishing to report on progress in more detail to do so. Additional indicators that had limited geographical coverage, or which may not be useful or possible to implement for most Parties, were assigned to the optional component or complementary indicator list (Box 1). The list of indicators in the monitoring framework represents a political agreement from Parties on the aspects of GBF that were determined to be the basis for monitoring its implementation.

The scientific guidance for operationalizing the monitoring framework followed the political process of selecting indicators[8]. Parties established an Ad Hoc Technical Expert Group (AHTEG) on Indicators in April 2023 to provide guidance for operationalizing the monitoring framework ahead of the COP16 meeting in October 2024. This expert group included 45 experts nominated by Parties and observer organizations[15] and was tasked with reviewing all the indicators, producing methodological guidance for implementing the monitoring framework, and assessing how well it covers the ambition of the GBF[16]. The AHTEG included individuals nominated by Parties and observer groups, selected for their expertise on the different aspects of the GBF and representing a diversity of scientific, technical and policy fields as well as Indigenous peoples and local communities (IPLCs) and youth.

The AHTEG worked with headline indicator developers and agencies supporting methodological research and capacity-building to ensure that each of these indicators had a robust methodology while

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BOX 1

The structure of the monitoring framework

Indicators

The monitoring framework relies on five types of indicators designed to track progress towards the goals and targets of the GBF[7]. In the context of the CBD, indicators can be defined as 'a measure based on verifiable data that conveys information about more than itself'[122]. These indicators include headline and binary indicators (which Parties are required, and expected, to report on), component and complementary indicators (which are optional) and additional nationally relevant indicators that Parties may choose. Through the structure provided by its indicators, the monitoring framework enables standardization of the outputs expected from Parties in their national reports.

Headline indicators are a minimum set of high-level indicators intended to capture the overall scope of a goal or target. There are a total of 26 headline indicators in the monitoring framework spread across the four goals and 15 of the 23 targets. Headline indicators are quantitative measures of process or outcomes relevant to each goal or target. These indicators are calculated from data mostly collated at the national level but can be aggregated or disaggregated to provide more in-depth information, for example, according to taxonomic group for species-related indicators or according to sectors of society (for example, gender and youth). In some cases, these data are obtained from third-party multilateral data aggregation tools, such as the World Database on Protected Areas. Headline indicators each have between 2 and 21 disaggregations recommended by the AHTEG and described in the metadata for each indicator. The use of recommended disaggregations is optional.

Binary indicators are qualitative measures of the efforts made by Parties to deliver on the GBF. These indicators are compiled from a set of questions to be answered by Parties and aimed at understanding the progress made towards implementing measures, processes and legislation to deliver on the ambition of the GBF[105]. The answers to the set of questions can be used to assign an overall score (from 0 to 5, showing an increasing level of implementation) for each binary indicator, providing valuable information about the progress made by Parties in facilitating and promoting the outcomes of the goals and targets. These indicators are simpler in design than headline indicators and are more readily compiled, although detailed consideration by Parties on which answer to choose will be needed.

Component and complementary indicators help monitor progress made towards the goals and targets beyond the information provided by the headline and binary indicators. Currently, 55 component and 124 complementary indicators are spread across all of the goals and targets[119]. Component indicators are intended to cover elements of the goals and targets that are not covered by headline or binary indicators. Complementary indicators support a more in-depth thematic analysis of the goals and targets.

Finally, national indicators include any additional indicators that Parties have established or developed, which they may choose to compile and report on, supplementing the other indicators. These national indicators may be relevant to the specific context of a Party and provide additional information on progress.

National reports

Regular national reports presented by Parties provide information on measures taken in support of the Convention's objectives and their outcomes. Six rounds of reporting were completed between 1994 and 2020; the seventh and eighth national reports are due in 2026 and 2029 respectively (Article 26). In the upcoming seventh and eighth national reports, Parties will be required to report on the headline indicators using data assembled through national biodiversity and ecosystem monitoring networks and relevant agencies and to provide responses for all the binary indicators. Where indicators are generated by international bodies using local, national, regional or global data, the values for each country will be pre-populated in national report templates. Parties can choose to use these values or replace them with their own where appropriate. Parties may further choose to include any additional optional indicators. Using the information submitted in national reports through the online reporting tool[123], the CBD Secretariat will be able to compile and track progress towards the GBF at the global level, for example, in the global report[124] on collective progress in the implementation of the GBF, which is due in 2026.

considering the real capacity constraints, limited data availability and other challenges faced by many parties (Fig. 2). The AHTEG also reviewed all component and complementary indicators to determine the availability of their methodology.

The AHTEG conducted a gap analysis, through a multi-step expert elicitation process[17–20] (Methods), to assess the degree to which the current indicators (headline indicators, their recommended disaggregations, and binary, component and complementary indicators; Box 1) cover each of the substantive elements of each goal and target. This gap analysis aimed to highlight limitations in the monitoring framework and support Parties in identifying opportunities to improve its effectiveness and coverage, given that Parties had agreed to keep the monitoring framework under review[7]. The AHTEG used a consensus-based expert elicitation process to perform the gap analysis. To assess the coverage of the monitoring framework, the text of each goal and target was split into elements (190 in total) reflecting distinct, independently measurable objectives that each need to be achieved for full implementation of the GBF (Methods). For each element, indicators were evaluated and their coverage by each relevant indicator and its disaggregations was assessed (see Box 2 for an example, Supplementary Table 2 for the complete list of elements and Supplementary Table 3 for the detailed assessment). Element coverage was assessed based on the level of development and testing of the indicator and its ability to inform on the element (Methods; see Box 2 for an example). From this, the AHTEG identified gaps and made general recommendations to Parties on improving the monitoring framework in a report for COP16 (ref. 21).

In this Analysis, we—members of the AHTEG and collaborators in the process—(1) present the results of the gap analysis under three implementation scenarios (from worst to best: (i) only required indicators are reported on; (ii) all headline indicator disaggregations are also reported; (iii) all optional indicators are also reported on) and review of the cross-cutting issues of the monitoring framework; (2) share recommendations made to Parties; and (3) suggest the next steps for effectively monitoring the implementation of the GBF. The monitoring framework represents texts negotiated by Parties, so we do not propose revisions to it. Instead, we focus on practical short-term and long-term recommendations for improving biodiversity monitoring that will benefit assessment of progress towards the current GBF and any equivalent future plans.

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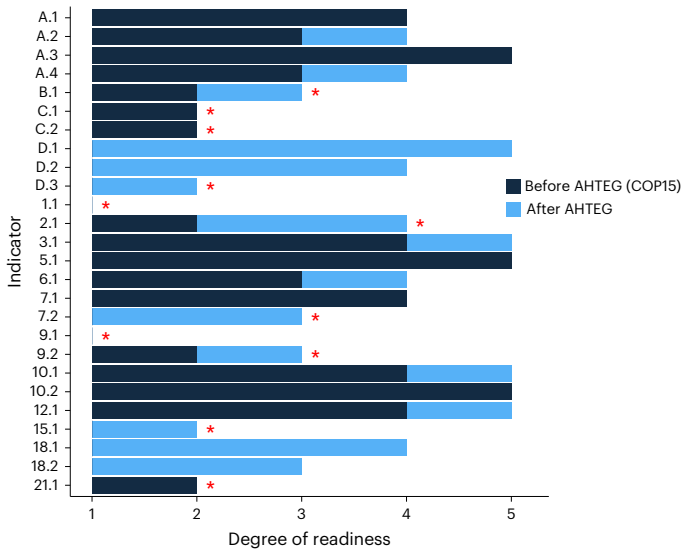

Fig. 2 | Degree of readiness of the headline indicators for the GBF. The dark blue bars show the readiness level at the time of COP15 (December 2022), while the light blue bars show the level in June 2024 (that is, reflecting progress since COP15). The red asterisks identify indicators that lacked an agreed methodology when they were adopted at COP15 (ref. 7). Readiness was scored as: (1) methods have not yet been developed and a process needs to be established to develop them; (2) methods have not yet been developed but a process is underway, led by one or more organizations, to develop them; (3) methods have been developed (or partially developed) and tested or piloted, but data are not yet widely available (or collection is not yet underway); (4) methods have been established, data are being compiled and the indicator is operational in at least some countries, but further investment in methods is ongoing or further data collection is required; and (5) methods have been established, data are being compiled and accessible, and the indicator is operational for most or all countries.

Gap analysis

Overall coverage. The indicators of the monitoring framework that are required in the national reports (binary and headline indicators without disaggregations) fully cover 19% (36 of 190) of the elements of the goals and targets and partially cover an additional 40% (76 of 190). Applying the recommended disaggregations of headline indicators increases this coverage to 22% (42 of 190) fully and an additional 41% (78 of 190) partially. The use of the indicators that are optional in the national reports (component and complementary) further broadens the coverage of the monitoring framework to 29% (55 of 190) fully and an additional 47% (90 of 190) partially (Fig. 3). Additionally, the use of recommended disaggregations of headline indicators, combined with the optional component and complementary indicators, reduces the number of elements excluded from monitoring of the goals and targets from 29% (56 of 190) to 12% (23 of 190), which implies a reduction of 59% in the number of gaps in the monitoring framework.

Importantly, many elements are not currently covered (that is, classed as gaps or potentially covered) by the indicators in the monitoring framework: 36–50% for goals (10–14 of 28) and 25–40% for targets (35–64 of 162). Ranges show values with and without inclusion of all disaggregations, component and complementary indicators. If all Parties report only on the required indicators (worst-case scenario), coverage will be limited to the lowest range value; coverage will be even lower if they are unable to report on some required indicators (for example, if data are not available). The highest range value will be reached if all Parties additionally report on all component and complementary indicators (best-case scenario). Realistically, we can expect some coverage in between to be achieved as some Parties choose to report on some optional indicators but not all.

The goals focused on conservation (A) and sustainable use (B) are considerably better covered (90–100% and 67–83% of elements at least partially covered, respectively) than those on benefit sharing (C, 0%) and resourcing (D, 20–60%; Fig. 3). Additionally, there are gaps in the coverage of the monitoring framework for all three sections of the targets: reducing threats to biodiversity (targets 1–8: 28–47 of 54, 52–87% at least partially covered); meeting people's needs through sustainable use and benefit sharing (targets 9–13: 19–24 of 39, 49–62% at least partially covered); and tools and solutions for implementation and mainstreaming (targets 14–23: 51–56 of 69, 74–81% at least partially covered; Fig. 3).

Headline indicators. Headline indicators alone will only allow partial tracking of progress, completely covering 20 of 190 (11%) and partially covering an additional 29 of 190 (15%) elements, and relating to only 16 of 23 targets. The disaggregations of these indicators, recommended by the AHTEG to enhance their ability to report on elements of the goals and targets, would increase coverage by headline indicators to 26 of 190 elements (14%) completely and an additional 31 of 190 (16%) elements partially.

While in principle the headline indicators can cover elements, in practice, data availability will limit application of many by countries. The coverage of some headline indicators could be improved by expanding geographical or taxonomic coverage through data acquisition and methodological development (for example, A.1, A.3 and A.4). Furthermore, several headline indicators (for example, B.1, 2.1, 3.1 and 6.1) have the potential to cover more elements of their specific goal or target if additional disaggregations can be developed (for example, according to ecosystem type or gender). In some cases, the current lack of potential disaggregations results from a methodological challenge (for example, 12.1); in others, it is due to data availability (for example, 6.1). Improving or broadening data collection for these indicators would potentially improve the coverage of the monitoring framework without the need to develop completely new indicators. Through disaggregation, some indicators may further support management plans targeting specific issues (for example, 3.1 according to areas of importance for biodiversity or by Indigenous and traditional territories; A.1 by drivers or by protected areas and other effective area-based conservation measures), in addition to tracking overall progress towards a goal or target.

Some headline indicators have been specifically designed after the adoption of the monitoring framework (for example, B.1, C.1, C.2 and 21.1) and have the potential to cover the respective goals and targets comprehensively but are not yet fully in place. Committing the resources needed to finalize, test and implement their methodologies would enable the monitoring of targets that currently cannot be monitored (Fig. 3).

Some headline indicators are so narrowly focused that they provide very limited coverage of their target; component and complementary indicators are needed to track progress effectively. Specifically, targets 5 and 12 are only sparsely covered because of the narrow focus of headline indicators 5.1 and 12.1 (Fig. 3 and Box 2); both are SDG indicators and cannot be amended easily.

Some targets are likely to require significant effort to fill the gaps identified. Specifically, the headline indicators proposed for targets 1 and 9 remain hypothetical (Fig. 2) and are a high priority for methodological development. In doing so, it may be helpful to identify synergies in data requirements that may simplify indicator compilation. For example, synergies between indicators are possible for targets 5 and 9 (addressing trade in wild species and benefits derived from the use of wild species, respectively).

Binary indicators. The 14 binary indicators cover 13 targets, eight of which have no headline indicator. They will provide a valuable source of information that can be used to rapidly and reasonably assess progress made on taking measures to deliver on goals and targets. However, by

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BOX 2

Gaps in indicators for target 12

An example for target 12 shows the separation of the target into its individual elements and coverage by indicators. The specific emphasis of each element to be monitored in the monitoring framework is highlighted in bold. This target contains nine (a–i) distinct elements that reflect its ambition to transform the relationship between cities and biodiversity. All other targets were similarly assessed in the gap analysis. Target 12 has a headline (12.1), binary (12.b) and component (City Biodiversity Index (CBI)[45]) indicator. Headline 12.1 was adopted by Parties partly because it is an SDG indicator with a development team and host organization based at UN-Habitat. However, this headline indicator falls short of measuring change in most of the elements included in target 12 because it only quantifies access to green spaces, which partially informs on element 12e (access to green and blue spaces) and could provide some indirect information on 12a (area of green spaces). Indicator 12.b further tracks the existence of measures in place for biodiversity-inclusive urban planning, enabling monitoring of 12g. The other elements of target 12 are not covered by its headline or binary but some (12a, 12b, 12f and 12h) could be monitored for those Parties choosing to report on the component indicator. Overall, monitoring progress on target 12 under the monitoring framework is therefore only currently guaranteed for one element, partially feasible for one element, potentially feasible and dependent on Parties' good will for four elements and not possible for two elements. In this case, the component indicator for target 12 is theoretically superior to its headline indicator but is not supported by any organization and requires a large amount of data, which is unlikely to be available in most cities. It is worth noting that the CBI was not a component indicator in the originally negotiated monitoring framework but was recommended as such by the AHTEG.

Target 12: Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanization and the provision of ecosystem functions and services.

target 12 elements	Mandatory indicator(s)	Coverage	Optional indicator(s)
12a. Significantly increase the **area of green spaces in urban and densely populated areas**	12.1[a]	Potential	CBI[b]
12b. Significantly increase the **area of blue spaces in urban and densely populated areas**			CBI[b]
12c. Significantly increase the **quality of green and blue spaces in urban and densely populated areas**			
12d. Significantly increase the **connectivity of green and blue spaces in urban and densely populated areas**			
12e. Significantly increase the **access to and benefits from green and blue spaces in urban and densely populated areas**	12.1[a]	Partial	
12f. **Mainstream the conservation and sustainable use of biodiversity in urban and densely populated areas**			CBI[b]
12g. Ensure **biodiversity-inclusive urban planning** contributing to inclusive and sustainable urbanization and to the provision of ecosystem functions and services	12.b[c]	Complete	
12h. **Enhance native biodiversity in urban and densely populated areas**			CBI[b]
12i. **Improve human health and well-being and connectedness to nature** through biodiversity-inclusive urban planning			

[a]Headline indicator 12.1 is based on SDG indicator 11.7.1, which measures the share of land allocated to public spaces and the total population with access to these spaces according to age, gender and disability. [b]The CBI is built on a score of 28 indicators measuring different aspects of a city's biodiversity and relationship to biodiversity[45]. [c]Binary indicator 12.b tracks the number of countries with biodiversity-inclusive urban planning referring to green or blue urban spaces.

their very nature, they cannot inform on the realized implementation (for example, what kind of measures, their breadth or relevance) or outcomes of these measures. As such, they can only track those elements in goals or targets that specifically call for actions (for example, target 15) and not the elements relating to the results of such actions. Therefore, for all targets calling for results and for which only binary indicators are available (targets 8, 14, 16, 20, 22 and 23), only partial coverage of the elements can be achieved with the current monitoring framework (Fig. 3). Efforts are needed to design fit-for-purpose quantitative indicators that can support the binary indicators to cover the outcome elements of those targets. Collaboration may help lower the burden of designing new indicators. For example, Women4Biodiversity developed an indicator on the Gender Plan of Action[22] (target 23) and the Global Youth Biodiversity Network is working on an indicator that may be suited to report on targets relevant to children and youth (target 22).

Complete gaps. For 23–56 elements (12–29%, Fig. 2), no indicators are available to track progress. There are three goals (B, C and D) and 11 targets (1, 2, 3, 4, 10, 11, 12, 13, 17, 18 and 19) containing elements that cannot currently be monitored under the monitoring framework (Fig. 3).

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For some of these (for example, D and 12), the gaps are sufficiently significant that new indicators may need to be added. For others (for example, 3 and 13), extending the methods or identifying disaggregation options for existing headline indicators to cover the gaps might be possible. Other targets (for example, 2 and 4) may require specific indicators to complement the existing headline indicators. These additional indicators could come in the form of component indicators specifically addressing the gaps identified (for example, target 2: 'enhancing ecological integrity and connectivity'), or additional straightforward binary indicators may suffice (for example, goal D: 'adequate capacity-building is secured'). Additional component and complementary indicators could be developed by organizations currently focused on those specific aspects of the goals and targets (for example, human–wildlife conflict[23]) whereas additional binary indicators could be proposed by Parties and follow the methodology designed by the AHTEG.

General recommendations

Improving the coverage of the monitoring framework. The GBF's monitoring framework has some important limitations. However, its adoption is a major step forward compared to previous strategic plans; the previous plan (the Aichi targets) did not have a monitoring framework, the use of indicators in national reports was optional and reporting was limited. Moving forward, the monitoring framework sets the stage for building and improving national monitoring systems and improving monitoring over time.

The limitations of the monitoring framework will be particularly important for countries to consider as they develop their national monitoring systems. Through the adoption of the mechanisms for planning, monitoring, reporting and review, Parties recognized that at the national level, each country should develop a national monitoring plan for monitoring their national biodiversity strategy and action plan and that this national policy should use headline, binary, component, complementary and national indicators as appropriate. Given the significant challenges in developing and implementing the indicators in the monitoring framework, it is highly unlikely that all Parties will use all of them. Because of capacity limitations, it is possible that some Parties will not report on all required binary and headline indicators. Additionally, the component and complementary indicators are optional, and the disaggregations of the headline indicators are recommended rather than mandatory, meaning these probably will not be applied by all Parties. Thus, gaps are inevitable and it is important for both Parties and the international community to see implementation of the monitoring framework as something that must be improved over time through both investments in national monitoring and scientific research. At this time, the biggest risk to effective tracking of global progress is a lack of ambition or capacity in implementing the monitoring framework.

Our results highlight that relying solely on the indicators required for national reporting will cover only some of the elements in the GBF. The monitoring framework could provide good coverage if the recommended disaggregations of the headline indicators, as well as the optional indicators, are implemented. For example, the current coverage for target 3 is entirely provided by disaggregations of headline indicator 3.1. A lack of ambition or resources from Parties could result in few component or complementary indicators or disaggregations being used and reported, especially for those Parties with more limited resources that must already be deployed on compiling the required indicators. In such a case, we would have little ability to judge whether most of the goals and targets were met in each country and at a global scale; much of the GBF would be unmonitored. Therefore, efforts must be made to ensure that

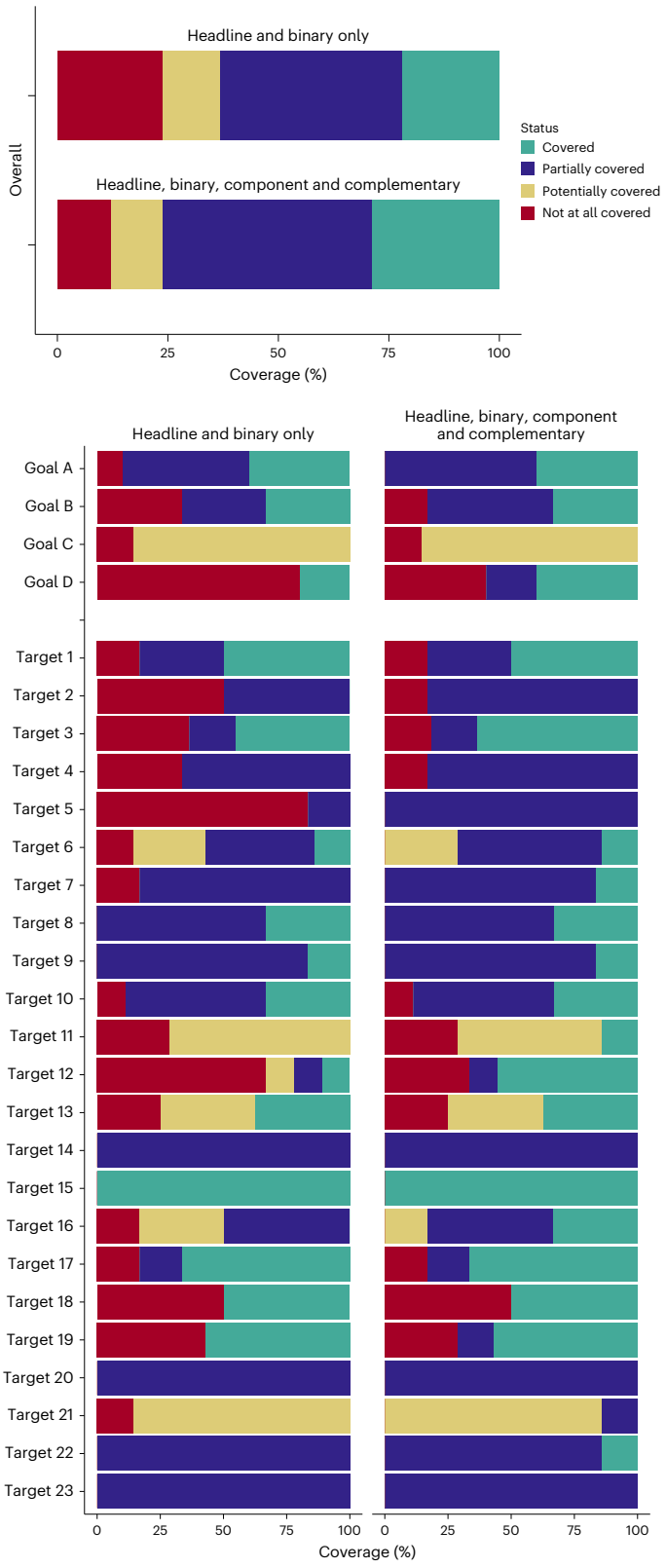

Fig. 3 | Coverage of elements of the goals and targets of the GBF by the indicators in the monitoring framework. Top, overall coverage of the indicators for all goals and targets in the GBF. Bottom left, coverage by the required headline and binary indicators for each goal and target, including the recommended disaggregations of the former. Bottom right, coverage by these indicators and the optional component and complementary indicators for each goal and target. 'Partially covered' applies to elements for which the indicator(s) track progress towards some aspects of the element but not all. 'Potentially covered' applies to elements that could be covered by indicators that are still in development, so there is uncertainty as to whether the final metric(s) produced will adequately cover the element. 'Not at all covered' means that no indicators (headline, binary, component or complementary) are available to monitor the element.

recommended disaggregations and optional indicators are included in national monitoring plans and reported in the national reports.

Particular attention should be paid to all those elements assessed as 'potentially' covered. Work is needed to develop appropriate indicators for these 25 elements as their adopted headline indicators are not yet ready for national implementation (Fig. 2). This presents a short-term opportunity to improve coverage of the monitoring framework with more limited investment of time and resources and without the need for further negotiation. Rapidly completing the development and testing of these indicators would allow goal C and targets 6, 11, 13 and 21 to be monitored effectively.

Specific gaps can be addressed at the national level using national indicators that are not included in the current list and do not require negotiations. Parties may develop these indicators at the national level or international organizations may do so at the global level and then disaggregate to the national level. This approach would not systematically address the gaps in the monitoring framework but would improve coverage of the GBF for some Parties and make available additional indicators for consideration in the next rounds of negotiations. (It is expected that the list of component and complementary indicators will be updated at COP17 and potentially at future COPs[24].) For example, while the monitoring of some aspects of freshwater resources and aquaculture are gaps, some Parties have chosen to report on their status using national indicators[25,26].

It is unlikely that new headline or binary indicators will be adopted by Parties and added to the monitoring framework before the next strategic plan for the Convention is developed in 2030. However, further component and complementary indicators may be added if they meet the criteria for inclusion, but these will remain optional. Therefore, while there are opportunities to fill specific gaps with additional indicators, as discussed above, improving the monitoring framework should be seen as a long-term endeavour that will continue over several years. Understanding the underlying reasons for gaps provides an opportunity to improve global biodiversity monitoring efforts. In the following sections, we address the general requirements for an effective monitoring framework for today and into the future.

Data needs. Many gaps or issues of partial coverage are linked to data availability. There are historical reasons behind the incomplete coverage of biodiversity data globally[27,28] that have resulted in poor coverage of many species, genetic diversity and ecosystem extent and integrity around the world, especially in tropical regions[29]. As such, improving sampling efforts of biodiversity data is a key priority for monitoring of the GBF, in particular for indicators A.1, A.4 and 2.1. Data collection, archiving and reporting efforts should follow the FAIR (Findable, Accessible, Interoperable and Reusable)[30] and CARE (Collective Benefit, Authority to Control, Responsibility, Ethics)[31] principles and take advantage of new technology on designing effective biodiversity monitoring systems to strategically fill gaps and compute indicators[32–35]. They should build on and make use of existing data infrastructures, tools and community-developed standards that provide mechanisms for sharing and integrating biodiversity data from diverse sources of evidence[36].

Ideally, biodiversity monitoring systems should be designed to integrate in situ observations gathered by conventional research programmes, such as long-term ecological research networks[37–39], or community-based monitoring and information and citizen science efforts[40], with remote sensing data[41] and expert judgement, to take advantage of big data[42] and potential advances in artificial intelligence[43]. To monitor the goals and targets of the GBF and link biodiversity outcomes to drivers of change, these data will need to be linked to national census surveys and other relevant physical, economic and social measures. However, gaps exist in these datasets and national census surveys may need to be updated to reflect the needs of the GBF. For example, questions on mainstreaming (target 14) may help address a data-poor section of the monitoring framework. One important reason for this poor and declining[44] biodiversity data coverage is the lack of investment and institutional support for biodiversity monitoring efforts[45]. However, many of the headline indicators are actively developed and supported by international organizations. If resourced, the same organizations can guide data collection, provide capacity-building and offer support to Parties. Additionally, civil society and volunteer efforts to collect biodiversity data provide significant value to states in administrative cost savings[46] and should be promoted and integrated with government-led biodiversity monitoring systems.

It should be noted that there is a difference between asking Parties for more disaggregated data (which would increase the burden of reporting) and overlay of data provided by Parties with information from other sources (which implies more effort in analysing the collated data). Ultimately, the issue of data collection, whether done by Parties or in collaboration with non-governmental organizations, is one of capacity[47]. Resourcing additional data collection efforts will be a significant challenge for many Parties and will require North–South, South–South and triangular collaboration, as well as financial resources to be made available.

Methodological needs. The issue of data is linked to the tools and methods currently available to detect trends in biodiversity and benefits derived[48]. Adapting the way biodiversity change is understood to better reflect the data available today is necessary to avoid difficulties in measuring change[49]. Furthermore, the scientific community has not yet come to a consensus on understanding and monitoring different facets of biodiversity and people's needs[50,51]. Indeed, the needs of the GBF go beyond biodiversity data and require that information on drivers of biodiversity change and societal outcomes be monitored (for example, for targets 9, 11 and 12), potentially requiring cross-sectoral data sharing agreements. In some cases, this results in the need for entirely new data collection and analytical methods, such as for financial flows[52] (indicators D.1, D.2 and D.3) and access and benefit sharing[53] (indicators C.1 and C.2). Specifically for access and benefit-sharing indicators, legal frameworks (for example, the Nagoya Protocol[54]) did not foresee the need to measure societal outcomes but rather national compliance metrics. Additionally, social processes related to participation, equity and rights (for example, for targets 22 and 23) also need effective monitoring to ensure that all parts of the GBF are implemented effectively.

Integrating across data sources and between social and ecological data is a significant challenge that requires well-designed pipelines and data products that can standardize information and make it usable for indicator calculation. For example, essential variables for biodiversity[55,56] and ecosystem services[57] can standardize multiple data types, enabling the use of analytical pipelines to compile indicators and support further development efforts. Additionally, approaches to recognize and support the role of Indigenous and local knowledge as complementary to the conventional scientific processes are improving[58,59] but more remains to be done for these to be systematically applied and fully inclusive[60].

One of the strengths of the monitoring framework is that it will enable consistent reporting of indicators by countries, supporting comparisons across countries and aggregation for regional and global synthesis. For example, the AHTEG recommended a consistent approach to compiling and reporting indicators related to ecosystems, their protection, restoration, sustainable use and status. This would allow the impacts of the actions (for example, restoration indicator 2.1) to be tracked on outcomes, such as the extent of natural ecosystems (indicator A.2) and their risk status (indicators A.1 Red List of Ecosystems). The AHTEG recommended using the International Union for Conservation of Nature (IUCN) Global Ecosystem Typology (GET)[61], endorsed in March 2024 as an international statistical classification by the UN Statistical Commission[62], to support consistent reporting

and disaggregation of ecosystem-related indicators by ecosystem functional group (level three in the typology). To do so, countries would cross-reference their national ecosystem classifications and maps with IUCN GET to enable reporting based on national ecosystem data and assessments. Significant progress has been made by Parties to map ecosystems[63] and tools are available to facilitate advancement[64]. Accelerating adoption would potentially allow a complete picture of given ecosystem groups (for example, coral reefs or tropical lowland rainforests) within a country, globally and across indicators.

An important focus area for systematic indicator calculation is interoperability[65,66]. Designing analytical pipelines capable of fully integrating and interpreting data types and meaning[67,68] and producing indicator calculations will significantly reduce the capacity needs of Parties[69]. Prioritizing these efforts to compile headline indicators and share code openly with all Parties could significantly reduce the equity and capacity barriers to monitoring the GBF and free up resources for Parties to include additional optional indicators relevant to their needs. Some of the infrastructure to enable this process is already in place[70–72] but additional efforts are required to fully operationalize it.

Finally, accounting for and reporting on uncertainty in biodiversity estimates and indicators will be essential to effectively guide the decision-making and implementation of the GBF. Uncertainty in trend detection capabilities has shed doubt on understanding global biodiversity change[73] and on the ability to detect improvement or further decline in biodiversity[49]. One solution is to use modelling techniques, such as Bayesian inference[49], that can allow updated estimates of progress as new data and evidence arise within a robust and rigorous framework for dealing with uncertainty[49,74]. Communicating uncertainty in indicator values to decision and policymakers is crucial for the monitoring framework to go beyond progress tracking and effectively support implementation.

Building the infrastructure to monitor biodiversity globally. The GBF is a common endeavour that, although Party-led, requires nations and stakeholders in them to work together[75]. The upcoming fast-track assessment by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on monitoring biodiversity and nature's contributions to people (NCP) will assess current capacity, identify needs and suggest solutions[76]. One solution is to support international cooperation by establishing a global biodiversity observing system (GBiOS). A GBiOS would support the implementation of national biodiversity monitoring networks[32,35,77,78] while assembling an international system similar to that used to monitor trends in climate (the World Meteorological Organization Integrated Global Observing System). This system allows countries to opt in and thus benefit from funding and shared resources and technologies, such as data and modelling infrastructure[79]. Therefore, by following this model, GBiOS could exist as a federated international network of national monitoring systems[66,78]. Over time, GBiOS could allow multilevel assessments of biodiversity trends that contribute to calculating indicators.

Headline indicator 21.1, on biodiversity information for monitoring the GBF, is currently under development (Fig. 2). At the highest level, this indicator could be evaluated if countries reported the number of headline indicators where national datasets, models, monitoring schemes and information tools are available and used. If aggregated and calculated over time, this would capture within and across country-level trends in the access and use of data on biodiversity outcomes. Development of Indicator 21.1 along three dimensions would measure the coverage in space and time of used and accessible data capturing trends in different biodiversity dimensions, the recognition and use of Indigenous and local knowledge of biodiversity, and the quantity and scope of active biodiversity monitoring activities and the data they produce.

This effort could be supported in the long term by information made available by GBiOS, by filling gaps in data coverage that hinder calculation of headline 21.1. Other indicators (for example, A.2, B.1, 2.1, 3.1) could rely on data collected and shared through GBiOS, addressing gaps in geographical coverage and data availability. Making GBiOS a reality requires (1) a sustainable and inclusive governance model allowing countries to opt in and actively participate; (2) a funding mechanism to support Parties looking to invest in their national biodiversity observation networks; and (3) the human capacity and technical infrastructure required to connect countries to an operational international network[21]. When brought together with other knowledge types, including Indigenous and traditional knowledge, scientific expert judgement, socio-economic data and information on governance and regulation, a GBiOS could generate the information needed to guide investments in monitoring capacity to fill the gaps in the monitoring framework.

Such a system would promote synergies between the CBD and the global climate agenda[80]. Climate monitoring systems are more advanced than those of biodiversity yet both crises are closely linked[81,82]. Some important differences between climate and biodiversity have limited efforts to connect these Conventions and their data collection systems: biodiversity metrics are less standardized[55]; their scale of change is more local and sensitive to small-scale changes[83]; methods for data collection are more diverse[34]; and the global policy relevance of the biodiversity crisis has lagged behind that of the climate crisis[84,85]. Yet, there are many synergies between monitoring climate and biodiversity (for example, nature-based solutions are an important component of climate policy[86,87]); connecting them would improve understanding of biodiversity change and support efficient data collection efforts[78]. Taking advantage of the capacity and knowledge already built in the climate space may also further the implementation of national and global biodiversity observing systems. Other sectors, such as those carrying out environmental impact assessments, also produce important knowledge and could contribute to monitoring of outcomes under the GBF[88].

Cross-cutting considerations. Section C of the GBF outlines the cross-cutting considerations for the GBF. It requires that the implementation of the GBF be consistent with the rights and contributions of IPLCs, different value systems, human rights, gender, intergenerational equity and human health[7]. While no indicators were specifically designed nor included to measure progress towards Section C, its considerations are partly addressed by using the existing headline and binary indicators as informative proxies. Indeed, some indicators are particularly relevant (for example, 9.1, 14.b, 22.b and 23.b), while others invite additional data collection to allow relevant disaggregation (for example, for IPLCs, women and youth for A.1, B.1, C.1 and C.2).

The considerations can be partly addressed by using indicators and disaggregations relevant for the defined social groups in Section C. Specifically for IPLCs, the CBD's four traditional knowledge indicators[89] could be used to complement the headline and binary indicators. In the monitoring framework, these are component or complementary indicators for certain targets and can provide a basis for disaggregating existing headline indicators (for example, for indicator 3.1 by disaggregating according to Indigenous and traditional territories). Further, the human rights-based approach to monitoring[90,91] is already applied to the traditional knowledge indicators and could be extended to the whole monitoring framework. Finally, particular attention is needed to address disaggregation according to gender, age, disability, IPLCs, education and socio-economic status. Although data availability and methodological challenges may limit the use of disaggregated data in the next national reports, the gaps, priorities and opportunities for data disaggregation and participatory approaches should be identified and advanced to improve future monitoring.

The monitoring framework further invites Parties and relevant organizations to support community-based monitoring and information systems (CBMIS). The contribution of CBMIS to monitoring progress and achieving biodiversity targets is well documented[92]. Some community-based monitoring tools implementing a human rights-based approach, such as the Indigenous Navigator[93], are already operational. CBMIS provide cross-cutting data and knowledge useful for monitoring

multiple targets and Section C[94]. Specifically, CBMIS collect data in remote areas where gaps are common even for well-developed indicators, as well as providing traditional knowledge relevant to the GBF[59,95]. Furthermore, CBMIS are community-focused, reflecting the needs and priorities of their members and different value systems[96]. Typically, CBMIS also collect information on health and human rights outcomes. Finally, community-based monitoring efforts in collaboration with scientists have been a cost-effective way of furthering understanding and managing biodiversity[97,98]. As such, these monitoring systems should be an integral part of data collection efforts wherever they exist.

Nevertheless, there is a need for more work to be done across all the cross-cutting elements of Section C because gaps remain in our understanding of how these topics interact with biodiversity. This was not assessed in detail in the gap analysis and remains an open area for research. This work is essential given that Parties often noted difficulties in taking Section C into account in the development of their national targets; only around one-third of the national targets submitted by Parties by October 2024 contained information on how the issues identified in Section C were being taken into account[99].

Next steps in implementing the monitoring framework

Reviewing and updating the monitoring framework. The work of the AHTEG, in collaboration with many organizations and individuals, has significantly improved the readiness level of existing indicators and the ability of Parties to use the monitoring framework[8]. Work on improving those indicators currently in the monitoring framework should be encouraged and appropriate organizations resourced. After the next round of reporting, there will be an opportunity at COP17 to review how the monitoring framework has been operationalized by reviewing what was reported by Parties. This engagement is key to the success of the monitoring framework.

The monitoring framework is expected to be kept under review thereafter, providing an opportunity for updates and improvements, based on its implementation by Parties, from COP17 onwards. This review process is expected to provide space for the addition of new, relevant and operational optional indicators as well as the updating and improvement of existing indicator methodologies. A formal process of update and review for the monitoring framework, akin to the annual refinement and quinquennial comprehensive review of the SDG indicators[14], but focusing on updating the list of indicators as well as their methodology, could be established to fill gaps and improve the monitoring framework. Such a process could learn from the AHTEG and include experts and stakeholders representative of the GBF with a clear mandate and resources to update the monitoring framework.

Addressing resourcing and capacity-building priorities. The most likely barrier to a successful implementation of the monitoring framework is one of human and financial capacity. Issues of equity are particularly relevant in this context because areas with the most biodiversity are often those with the least capacity to monitor its status[100]. Without the resources to implement the required indicators in the monitoring framework, many Parties will not be able to report on them and gaps will remain unfilled; thus, uncertainties about progress under the GBF will persist. Through COP decisions, Parties have committed to prioritizing biodiversity planning and monitoring nationally. Financial resources are now needed to establish and strengthen national and regional monitoring frameworks. These resources should be used to build nationally relevant biodiversity observation systems with the people, technologies and knowledge systems needed to implement the monitoring framework.

The challenge in funding monitoring will be particularly acute for those Parties with the least resources, for which multilateral and innovative funding sources may be required. While governments will need to invest more into monitoring, private sector actors also have a role in enhancing funding levels and deploying innovative solutions. Around half of the world's gross domestic product is moderately to highly dependent on biodiversity[101], meaning that private companies and financial institutions have a considerable stake in this issue. Direct engagement of the private sector in supporting biodiversity monitoring efforts[102] must respect the rights of all communities involved and ensure that all data are collected fairly and equitably. Additionally, the implementation of benefit-sharing agreements under the CBD and its Nagoya Protocol, as well as the newly created multilateral mechanism for the fair and equitable sharing of benefits from the use of digital sequence information on genetic resources[103], may help build capacity among those Parties where the genetic resources are being sourced[104], as well as among IPLCs.

Finally, beyond national efforts, global cooperation is required to resource the organizations that are supporting methodological research and capacity-building around the indicators. This is essential for the full development of indicators and their disaggregation, to enhance harmonization among indicator frameworks when relevant (for example, United Nations Framework Convention on Climate Change work on indicators under the global goal on adaptation) and to increase the coverage of indicators that support the effective implementation of the monitoring framework over the long term.

Conclusion

The adoption of the monitoring framework was a monumental achievement. This decision by Parties represents a shift in how transparency and responsibility will be assured. The Convention has moved away from national reports containing largely qualitative narrative, to reports requiring quantitative indicators. Despite its existing limitations, the monitoring framework marks a paradigm shift in implementing the CBD. Further developing and implementing it will be challenging, but changing the status quo is never easy.

The monitoring framework has been developed considerably since its first draft was negotiated[7]. The present analysis shows that, despite the gaps identified, there is a large quantity of data, indicators and knowledge available to implement the monitoring framework, making use of the guidance and resources available. It now stands ready to inform on progress towards achieving global goals and targets in a way that has not been previously possible. However, its effectiveness will depend on the degree to which Parties implement it. While all Parties must balance multiple priorities and face practical, technical, financial and social constraints on what can realistically be monitored, the ambition of Parties in implementing monitoring and reporting indicators will determine our ability to judge progress towards the goals and targets, and, ultimately, whether they have been achieved. The monitoring framework provides an opportunity to develop and invest in national biodiversity monitoring systems and to improve national and global data sharing and connection of monitoring systems.

The academic and non-governmental organization communities have roles to play in supporting implementation by providing capacity-building, training and data-informed workflows, which are required to lower the barriers to implementation, especially for developing nations. Academic and citizen scientists, non-governmental organizations and IPLCs have an important role to play in collecting data and compiling indicators to help Parties report on the many indicators of the monitoring framework. While the gaps identified in this study are concerning and should be addressed, a failure to implement the monitoring framework will result in a much greater number of gaps. We strongly encourage the scientific community and other relevant actors to engage with and support Parties in their efforts to implement the monitoring framework. Its implementation through the seventh national reports expected in 2026 will provide a first opportunity to gauge the adequacy of monitoring and the extent of progress towards achievement of the GBF.

The monitoring framework will be essential to delivering on the ambition of the GBF by 2050. It should be considered a global learning

mechanism, allowing enough flexibility for Parties to meet their objectives while sharing progress and experiences globally to improve outcomes for the whole of society. The achievement of the GBF targets for 2030 and the vision and goals for 2050 depend not only on the comprehensive and effective implementation of policies and actions but also on effective implementation of the monitoring framework.

Methods

The work of the AHTEG

Headline indicators. The methodologies for compiling headline indicators were reviewed, revised or, in some cases, developed de novo by the AHTEG, in consultation with relevant organizations and experts. Metadata covering the rationale, methods, available data and possible disaggregations for compiling each indicator are available for all headline and binary indicators agreed at COP15 except for two (Fig. 2)[105].

The work of the AHTEG started with the evaluation of the metadata for each indicator by sub-teams of experts on each topic. The existing metadata for each indicator was assessed for completeness and whether it clearly reflected the latest guidance and methodology for indicator calculation. This also involved assessing whether the data required to calculate the indicator were freely available for all countries. Shortfalls in methodology, data and the description of the indicator were considered and documented for each indicator. Depending on the levels of development of the indicators, AHTEG members worked directly with agencies supporting methodological research and capacity-building for the indicators to revise the metadata, providing advice, text edits and methodological revisions where needed, and in some cases, the development and initial testing of new indicators.

Binary indicators. The selection of questions and evaluation of potential answers involves careful consideration if binary indicators are to provide meaningful metrics of progress towards the goals and targets. The AHTEG reviewed the proposed text of binary indicator questions and answers to produce goal-specific and target-specific guidance on interpreting questions and answers. This guidance is outlined in the metadata of each binary indicator[105]. Additionally, the AHTEG developed a methodology to aggregate responses across questions using mutually exclusive answer combinations to produce an overall score for each Party that can be used to track global progress towards implementing the measures required to deliver on the GBF.

Qualitative cross-cutting considerations. Section C of the GBF outlines a set of cross-cutting considerations to address in the implementation of the GBF and which are relevant to the monitoring framework. Some of these cross-cutting considerations (namely human rights, gender, IPLCs and the ecosystem approach) were reviewed by the AHTEG in the context of the monitoring framework and its indicators. Specific guidance[105] was provided for considering human rights and ecosystem approaches and how these could be implemented in the monitoring framework. Current limitations in the ability of the monitoring framework to track progress towards the cross-cutting considerations were also assessed.

Gap analysis of the monitoring framework

Gap analysis through expert elicitation. Gap analyses are used to identify areas where knowledge, data or action are lacking relative to a desired outcome or standard[106–109], in this case the ability to monitor comprehensively the GBF's goals and targets. Gap analyses are common practice in fields where action needs to be taken, resources are limited and knowledge is incomplete, as is often the case in conservation[17,18,110] and resource management[111,112]. A common method to carry out a gap analysis is through the use of expert elicitation[112–114].

Experts who, through formal training, have acquired skills and experience, are deemed more able to critically assess a situation and identify where gaps exist[115]. We refer to experts as 'people who are considered by their peers and society at large to have specialist knowledge and who are consulted to make an estimate'[20]. However, expert judgements are dependent on the kinds of experts convened and the way their knowledge is elicited[20].

The process of selection of the AHTEG is described in the terms of reference for the AHTEG, specifically ensuring representation of different areas of technical expertise and ensuring balance in expertise on all aspects of the goals and targets of the Kunming-Montreal Global Biodiversity Framework, also taking into account geographical representation, the representation of IPLCs, women and youth groups and major stakeholders, gender balance and the special conditions of developing countries, in particular the least developed countries and small-island developing States, and countries with economies in transition, also taking into consideration the special situation of developing countries that are most environmentally vulnerable, such as those with arid and semi-arid zones, and coastal and mountainous areas[15].

The potential limitations of expert judgement can be further mitigated through the use of well-established structured procedures[115]. In this study, we followed a multi-step process using individual reflection, focus groups and broad discussion over the course of several months, which are detailed below.

Mapping out the ambition. The AHTEG was mandated to analyse whether the indicators in the monitoring framework could track progress towards the GBF's goals and targets. This task required analysis of the full ambition of the GBF as reflected in the wording of the goals and targets agreed by governments after the lengthy negotiations through the CBD. The text of each goal and target is often long and complex, containing multiple clauses and components that are each important to deliver on the ambition of the GBF. To enable a comprehensive and holistic analysis of the monitoring framework's ability to track progress towards the whole GBF, the text of each goal and target was first divided into a set of distinct elements. This built on work that the co-chairs of the Open-ended Working Group on the post-2020 Framework conducted on identifying the elements of each goal and target. Elements were defined as those components of the goal or target that would need to be measured and reported independently to evaluate whether the goal or target had been fully achieved. The rationale for this approach built on the methodology used to assess progress made towards the Aichi Biodiversity targets, which concluded that none of the targets had been fully met but some had been partially met based on achievement of one or more elements in those targets[5]. The elements were defined exclusively by the text of the goal or target, without the relevant considerations from Section C of the GBF.

This exercise was undertaken in two steps: an initial list of elements across most of the goals and targets was proposed by one AHTEG member and was shared online with all other AHTEG members for review and commentary. All AHTEG members were then invited to make suggestions to further split, combine or redefine the elements based on their specific knowledge of different aspects of the GBF. A consolidated list of elements was thus agreed by all AHTEG members (Supplementary Table 2). Separately, three expert groups, also involved in the development of specific indicators in the monitoring framework, were invited to propose elements relating to the remaining goals and targets on which they were focused: specifically, the Liaison Group on the Cartagena Protocol on Biosafety for target 17, the Informal Advisory Group on Technical and Scientific Cooperation for target 20 and the Technical Expert Group on Financial Reporting for goal D and targets 18 and 19.

Because of the complexity of the language of some goals and targets, incorporating multiple commitments including both actions and outcomes, the number of elements for each varies considerably. For example, target 12 contains nine such elements (Box 2; Supplementary Table 2 for the complete list of elements for all goals and targets). The number of elements ranged from four for target 23 to 14 for target 22, with a median of six and a total of 190 elements across all goals and targets (Supplementary Table 3).

Assessing coverage. The indicators in the monitoring framework were then mapped to the elements of each goal and target to identify how comprehensively the GBF could be monitored. That is, for each element, the relevant headline indicators, their disaggregations, binary indicators and component or complementary indicators were checked to see if they were able to inform on progress towards the element (see Box 2 for an example). Note that the cross-cutting considerations set out in Section C of the GBF were not considered in the coverage of the indicators. The results and explanations for the coverage status of each element were made available to Parties ahead of the 26th meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA)[21] (Supplementary Table 3).

This process was conducted through a two-step direct elicitation process[17,116]: first, a remote elicitation[19,117] step via a survey shared with all AHTEG members before the AHTEG's sixth meeting in Cambridge (March 2024); second, a structured facilitated working session[118] at that meeting.

The survey's focus was broadly to identify where the headline and binary indicators covered the elements of the goals and targets and where component and complementary indicators might support monitoring of the elements. Respondents were asked to select those elements that they thought could be monitored using each headline and binary indicator in turn; then they were given the option to repeat this for any complementary or component indicator of their choice. At this stage, respondents did not have access to the updated metadata and list of component and complementary indicators. As such, respondents were specifying whether the intent and concepts behind the indicators could map onto each element rather than realized indicators with methodology. Therefore, the survey results were not used to report on the gaps in the monitoring framework but rather to guide the in-person session in Cambridge.

At the meeting in Cambridge, after all the indicators and their methodologies had been reviewed, AHTEG members discussed the results of the remote elicitation step during an inception meeting[19]. The results of the survey were presented by a facilitator through a series of graphs. The facilitator then proceeded to explain how the in-person process would be split between a focus group session, where AHTEG members would be given a set of questions to work on in small groups, followed by a larger group session to review the results of the focus groups and discuss any divergence in opinions between experts[19]. During the focus group session, AHTEG members were asked to split up into self-directed groups of expertise, focusing on specific goals and targets. In each group, AHTEG members were given the same task with clear questions to review all the goal or elements individually. For each element, groups were asked to list the headline or binary indicator (including recommended disaggregations of headline indicators where relevant) that would allow tracking of progress on the element. When a headline or binary indicator was assigned to an element, groups were asked to qualify the coverage of each element by the corresponding indicator with one of three options: 'covered', that is, an indicator has been developed and tested in at least some countries and can inform progress on the element; 'partially', that is, an indicator has been developed and tested in at least some countries and can inform progress on part of the element, without fully capturing the full scope of the element being addressed (that is, it indirectly addresses the element, tracking legislation put in place but not its impact, or it only addresses the element in part—tracking harvest of fish species rather than wild species); 'potentially', that is, an indicator for the element is still under development or has not been tested but once completed and tested, it is expected to be able to track progress on the element (that is, headline indicators with methodology in development (Fig. 2) or developed indicators with missing disaggregations that could inform on the element but are not currently available). For each of these categorizations, participants were asked to provide a brief explanation (justification and caveats) for their choice and specify, in the case of headline indicators, whether a specific disaggregation is required to inform progress on the element. For elements where no headline nor binary indicator could inform progress, participants were asked to suggest component or complementary indicators that may be appropriate to inform on progress towards these elements.

This process was repeated after the meeting in Cambridge for specific indicators that had not received sufficient attention during the meeting. These subsequent exercises were conducted with AHTEG members for targets 14 and 16, with the Technical Expert Group on financial indicators for goal D and targets 18 and 19, and with relevant members of the Secretariat for targets 17 and 20.

Percentage coverage was assessed by calculating how many elements were in each of four categories (fully, partially, potentially or not covered) for each goal or target for each of three scenarios, considering (1) only required (headline and binary) indicators, (2) required indicators and their disaggregations or (3) required indicators, their disaggregations and optional (component and complementary) indicators (three scenarios in total).

The results of these processes were analysed and compiled into a report[105]. These were shared with all participants before submission for review and feedback. Participants were asked to review the results individually once more to confirm that these accurately represented the consensus opinions of the AHTEG.

After the 26th meeting of the SBSTTA in Nairobi (May 2024), the results of the gap analysis were updated to reflect the new language of the binary indicators[119].

Limitations

It is important to acknowledge that although the gap analysis was conducted by experts, many of whom were actively involved in the design of the methodology for indicators and the overall monitoring framework, under a formal structured process, the results reflect their judgements at the time the exercises were carried out. Potential conflicts of interest were handled through a collaborative process including all AHTEG members and an external peer review of the gap analysis report before COP16. Repeating this process with different individuals having access to the same information may yield somewhat different results. However, few, if any, people were more well versed in the monitoring framework than the members of the AHTEG when this work was conducted; their judgement was recognized and used as the basis for decision-making and recommendations at 26th meeting of the SBSTTA[120] and COP16 (ref. 121).

Updates to the monitoring framework after COP16

While the first part of the meeting of COP16 (in Cali, Colombia), did not finalize an agreement on the updates to the monitoring framework, negotiations on the indicators resulted in the possible editing of one headline indicator, the addition of one headline and one binary indicator, and the removal of four component indicators[121]. Indicator 7.2 was singled out for a change that remains to be decided (in COP16 part 2, Rome, February 2025). The new headline indicator 22.1 tracks land-use change and land tenure in the traditional territories of IPLCs. The new binary indicator 5.b asks Parties about the existence of legal instruments or other policy frameworks to regulate trade in wild species. Neither of these indicators was present in the monitoring framework when the gap analysis was carried out[120]. Therefore, the potential increase in coverage from their addition is not included in this work. Additionally, all four component indicators removed were for target 18: revenue generated from biodiversity-relevant taxes, fees and charges; monetary value of biodiversity-positive subsidies; number of other positive incentives in place for biodiversity (by type); and monetary value of other positive incentives in place for biodiversity. Removing these component indicators will probably reduce the coverage of the monitoring framework for target 18, which is not reflected in our results.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

Summary data used to produce the figures and results in this article are publicly available at https://figshare.com/s/ae2e94d993e078b0aaba.

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Additional information

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Reporting Summary

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Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☒	☐	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☒	☐	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐	A description of all covariates tested
☒	☐	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☒	☐	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☒	☐	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Data were collected through an in person expert elicitation workshop asking participants to rank coverage for elements in the monitoring framework, the answers of which were summarised into counts of how many elements were covered and how for the analysis
Data analysis	The data analysis consisted of counts and proportion summaries of the reported views during the workshop. We counted how many elements were covered for each indicator, across the monitoring framework and for specific groups of indicators. Counts and proportions are all reported in the article.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

The data used in the analysis are available on Figshare

Research involving human participants, their data, or biological material

Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	Workshop participants were evenly split along gender lines as per UN requirements.
Reporting on race, ethnicity, or other socially relevant groupings	As per UN criteria, research participants represented a mix of ethnicities, ages and backgrounds to ensure representation of the membership of the Convention (196 countries) and other relevant groups (IPLCs, women, youth).
Population characteristics	All participants were experts in various aspects of biodiversity science.
Recruitment	Participants to the workshop were members of the AHTEG, an expert group assembled by the United Nations Convention on Biological Diversity.
Ethics oversight	*Identify the organization(s) that approved the study protocol.*

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences ☐ Behavioural & social sciences ☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see nature.com/documents/nr-reporting-summary-flat.pdf

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	The study is a gap analysis of the Global Biodiversity Framework's (GBF) monitoring framework conducted by an expert group through a participatory workshop where all text of the GBF was mapped to available indicators to identify gaps in reporting ability.
Research sample	NA
Sampling strategy	Workshop based set of questions to be answered by self organised focus groups
Data collection	Participatory expert elicitation workshop
Timing and spatial scale	Data were collected during the workshop on the week of March 13th 2024
Data exclusions	No data were excluded
Reproducibility	We followed best practice for a gap analysis via expert elicitation workshop
Randomization	NA
Blinding	NA

Did the study involve field work? ☐ Yes ☒ No

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology and archaeology
☒	☐ Animals and other organisms
☒	☐ Clinical data
☒	☐ Dual use research of concern
☒	☐ Plants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Plants

Seed stocks	NA
Novel plant genotypes	NA
Authentication	NA