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The Future of the Global Environment Outlook: Considerations for Positioning and Assessment Design

Background Paper

January 31, 2021

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Abbreviations

CBD	Convention on Biological Diversity
CLA	Coordinating Lead Author
CPR	Committee of Permanent Representatives
GBO	Global Biodiversity Outlook
GEAs	global environmental assessments
GEO	Global Environment Outlook
GSDR	Global Sustainable Development Report
HLCP	High-Level Committee on Programmes
HLG	High-level Intergovernmental and Stakeholder Advisory Group
IAC	Inter-Academy Council
IAMs	Integrated Assessment Models
IEA	integrated environmental assessment
IISD	International Institute for Sustainable Development
ILK	Indigenous and Local Knowledge
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRP	International Resource Panel
LA	Lead Author
MEAs	Multilateral Environmental Agreements
OECD	Organization for Economic Cooperation and Development
RE	Review Editor
SAP	Scientific Advisory Panel
SC	Steering Committee
SDGs	Sustainable Development Goals
SoE	State of the Environment
UNCCD	United Nations Convention to Combat Desertification
UNDESA	United Nations Department of Economic and Social Affairs
UNFCCC	United Nations Framework Convention on Climate Change
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
WESR	World Environment Situation Room
WMO	World Meteorological Organisation
WTO	World Trade Organization

1 Introduction and context

Following the launch of GEO-6 in March 2019, UNEA-4 noted the evolution of GEO's approach over the years and concluded in decision UNEP/EA.4/RES.23 to launch a broad *consultative process* on the scope and objectives of GEO in the future. To this end, it called for the establishment of an intergovernmental steering committee (SC) to manage the consultative process and oversee the preparation of an options document. According to the mandate, "the options document should address the role of the Global Environment Outlook process in regularly preparing independent analyses of the state of and trends in the global environmental situation". UNEA also called for the scope and objectives of the Global Environment Outlook process considered in the options document to be informed by the United Nations Environment Programme Guidelines for Conducting Integrated Environmental Assessments (UNEP 2019a).

In support of this process, the SC and UNEP commissioned the drafting of a background paper by the International Institute for Sustainabe Development (IISD) to support the consultative process aimed at identifying and analyzing options for the future of GEO. The key question and overall contribution of the background paper is to inform the consideration of options on GEO's possible contribution to UNEP's overall mandate to keep the world's environment under review.

The background paper is informed by in-depth research on a number of underlying topics in designing of global integrated environmental assessments (IEAs) that are critical for the identification and analysis of options. In addition to the research, the consultants carried out a series of semi-structured interviews with senior representatives of UNEP's partners and leading assessment experts about the future of GEO. Some excerpts of these interviews are included in this paper to provide complementary perspectives on the topics that have been analysed. The list of interviewees is provided in Annex 3.

The background paper is structured as follows. Section 2 provides an overview of the history of GEO, Section 3 starts off with a discussion of the need to consider positioning assessments such as GEO in an increasingly complex global environmental assessment landscape, followed by a discussion of the range of diverse functions an assessment can play. Section 4 reviews the importance of assessment governance, including its role, forms, functions and mechanisms. Section 5 reviews considerations for assessment process design and the selection of methods. Section 6 looks at the outputs of assessments and Section 7 the closely related question of assessment uptake, use and learning. Section 8 discusses the financing of assessments. The concluding section summarises the main findings of the research. Sections 3-8 also start with a box providing key findings.

2 History and Evolution of GEO

Keeping the state and direction of the world's environment under review is a monumental task that the founders of the UN Environment Program (UNEP) believed was crucial for the mission of the world's leading environmental organization (UNGA 1972). Since its establishment in 1972, UNEP has answered this call by undertaking a series of assessment and reporting processes and disseminating many print and electronic products.

With the emergence of the topic of sustainable development following the Brundtland Report in 1987 and the Rio Summit in 1992, it became increasingly clear that UNEP needed a new comprehensive report on the global state of the environment. In decision 18/27 C of 25 May 1995[1] UNEP's Governing Council requested the Executive Director to prepare such a report in cooperation with several UN agencies and the World Bank based on research publications. The decision listed an extensive list of environmental challenges to be covered in the state of environment part of the report. The Council also requested the report to include an outlook part, which amongst others was to address population growth, consumption and production patterns and economic development. The new report was also to include a part which addressed conclusions and recommendations on responses that could reverse unwelcome trends and challenge principal threats to the environment. The first Global Environment Outlook (GEO) was prepared in response to this decision. The preparation of the report also took into account that the Council through paragraph A4 of the same decision endorsed "the refocused strategy of UNEP to undertake, at the request of Governments or their representative bodies, policy-relevant assessment and reporting of environment and development issues of international significance through cooperating networks of appropriate national and regional agencies, organizations or institutions, and to promote the development of data and information management capacity in those bodies situated in developing countries as necessary and appropriate to ensure their full participation."

The new instrument was to be grounded in an integrated perspective to cover the dynamic interactions between the different environmental issues, between environment and development and link scientific knowledge clearly to policy. It was also envisioned as a mechanism to engage all UNEP divisions, regional offices and external partners and offer a link between global, regional and national perspectives. Due to its integrated character, GEO was considered as an opportunity for strengthening UNEP's role, as several major organizations interested in sustainable development had entered the environmental scene (Bakkes et al. 1998). Both the scope as well as the setup of the assessment pioneered an approach that was adopted by a wide range of integrated global assessments that followed.

To date six global GEO reports have been published at intervals of 3-7 years, their publication dates influenced both by the practicalities of completing an ambitious global process and the schedule of key events, such as the Millennium Summit in 2000, the 20th anniversary of the launch of the Brundtland report, the Rio+20 conference in 2012, and the launch and review of the Sustainable Development Goals (Figure 1).

[1] http://wedocs.unep.org/bitstream/handle/20.500.11822/17274/95_GC18_report.pdf?sequence=22&isAllowed=y

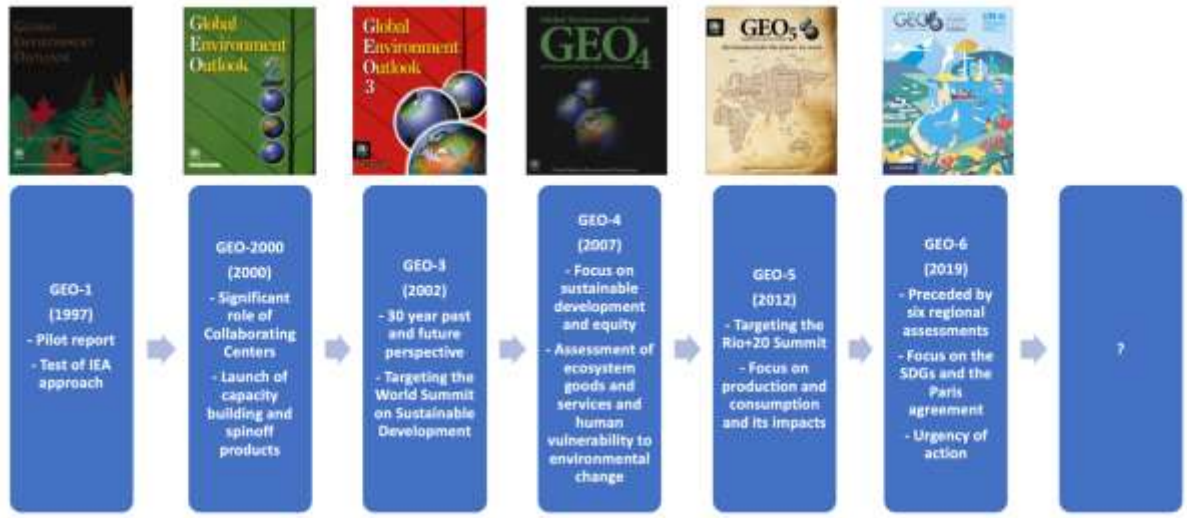

Figure 1: The sequence of the main GEO reports published by UNEP to date (Stockholm Environment Institute and UNEP 1997;UNEP 2000; UNEP 2002; UNEP 2007; UNEP 2012; UNEP 2019b)

Following the contribution of the fifth GEO to the Rio+20 Conference in 2012, the Rio Outcome Document reaffirmed the need for an integrated environmental assessment. It called on UNEP to "Promote a strong science-policy interface, building on existing international instruments, assessments, panels and information networks, including the Global Environment Outlook, as one of the processes aimed at bringing together information and assessment to support informed decision-making" (UNGA 2012).

Throughout the 20+ years of its history, GEO evolved in response to new expectations of governments, an increasingly complex assessment landscape, advances in science and technology, and changes in the state and trends of the environment itself. While certain aspects of assessments evolve, they can also run the risk of becoming path-dependent and lose the agility needed to engage with dynamically evolving socio-cultural, technical or political contexts. With the growing number of assessments, it is becoming harder - but more important - to articulate an assessment's place in the global assessment landscape and in the science-policy interface (Maas, Kok and Lucas 2020).

A major development of the GEO process followed the request by the UNEP Governing Council in decision 23/6 of 7 April 2005 for governments to be more closely involved in the preparation of the fourth GEO. Consequently, the UNEP secretariat established features in the GEO process to allow for governments and stakeholders to be involved together with independent experts in the scoping and the review of the report as well as in the co-production of a summary for policy makers. Stricter guidelines for the selection of experts and the use of more recent data and peer-reviewed literature were also introduced. These features have been further developed in the fifth and sixth GEO. The trade-off associated with these changes was the gradual devolution of a global Collaborating Center network that played a key role in the production of previous GEOs.

The latest assessment in the series, GEO-6 was completed in 2019, based on a now expired Resolution 4 of the first meeting of the United Nations Environment Assembly (UNEA). A series of regional GEOs was completed in 2016, upon which the global assessment was to be built.

3 Assessment functions

Key Messages

- Global environmental assessments aim to improve the quality of environment-related decision-making and the likelihood that good decisions will be made. To this end, assessments 1) build a shared understanding of the state of knowledge and present the findings to a potentially broad set of users; 2) support improved knowledge generation; 3) enhance awareness regarding environmental, social and developmental challenges and possible solutions.
- To meet its ambition, not only the quality of the assessment product, but also the process is key for an impact. Assessment processes and products need to take the multiple pathways through which they can lead to impact into account.
- Impact is realized on the science-policy-*society* interface that engages assessment experts, policymakers and societal stakeholders in assessment as a process of co-creation.
- Demand for an assessment of scientific knowledge emerges among others from the 2030 Agenda for Sustainable Development, the UN Environment Assembly, the Rio Conventions, the landscape of global environmental assessments, and multilateral environmental agreements. Demand is also driven by business and civil society.
- The specific functions of GEO need to be defined in view of the assessment's present and intended place in the global assessment landscape. Specific functions discussed include: informing UNEA and supporting policy planning, implementation and review at global and sub-global levels; advancing and demarcating integrated, systems-based perspectives; leveraging other assessments and UNEP work; formulating, implementing and assessing progress towards global goals; data, data interpretation and use in assessment; support for and use of thematic and integrated models and scenarios; and contribution to capacity building.

Defining the purposes and functions of a Global Environmental Assessment (GEA) needs to first take a number of contextual issues into account, including mandate, theory of change, interface with science, policy and society, and fit within the landscape of other GEAs. Specific functions relevant for the consideration of a future GEO are discussed following the introduction of four contextual themes relevant for GEO.

3.1 Mandate and overall purpose

The origins of the GEO report can be traced to the founding document of the UN Environment Programme secretariat and its Governing Council in 1972 (UN General Assembly resolution No 2997 XXVII). The evolving direction for keeping the world's environment under review, as provided by the UNEA (and formerly the Governing Council), and particularly in relation to the emergence of the 2030 Agenda and the Sustainable Development Goals (SDGs), combined with

how much the landscape of global environmental assessments has grown since GEO-1, necessitates a review and update of the current mandate and function of GEO.

It is important to note that while 'GEO' and the GEO mandate as noted above refers to the global assessment process and report, during its decades of history many more GEO reports, using the IEA approach but having a more specific focus have been prepared. Also published under the GEO brand, these assessment processes and products provide more specific detail from the perspective of specific sectors or geographic units. Regional GEOs, GEO for business, GEOs for certain types of ecosystems or GEOs at the city level are examples of the broad applicability of the model and its resonance with diverse stakeholders and indicate a demand well beyond the global GEO reports.

Scoping out the functions of global environmental assessments must recognize their significant complexity and unique place in the broader context of global governance, to the point that they can be considered distinct institutions in their own right. According to Biermann (2002), assessments are not directly engaged in environmental protection, but their key function is to provide "comprehensive and reliable advice on the state of the environment and on policy options, which reduces transaction costs for governments". By providing credible information when and where it is needed, the function of global environmental assessment can be considered in the broadest sense as improving the quality of environmental sustainability-related decision-making and increasing the likelihood that good decisions can and will actually be made. While assessments have several more specific functions, most fall under this broad category.

3.2 Theory of Change

Theories of change describe how an intervention such as an assessment contributes to impact through its functions. The theory of change must recognize the complexity of assessments, with multiple processes and products and diverse audiences, often with different expectations. If a key function of assessments is to improve governments' decision-making, the theory of change expresses how that function is realized through an assessment's processes, products and their use by that target group. These features would need to be different, if the main function is decision making of non-governmental actors, awareness raising, a scientific audience, etc. Within an assessment process such as GEO, impacts are often realized through multiple channels, including but not limited to the main assessment reports, capacity building, thematic assessments, digital products and more importantly through processes of participation and learning. In the future, the theory of change of GEO could be supported by a continuous monitoring of policy changes and impact of GEO on environmental outcomes, society and development.

The theory of change for GEO-6 has been described as "a social process that moves a community of institutions and people towards a new way of (strategic) thinking and (goal-oriented) acting" (UNEP, 2019a). The outputs of GEO-6 are then intended to influence the future path of environmental and sustainable development policy. Outcomes of the GEO-6 process should lead to increased awareness about the current state of the environment, improved knowledge of the possible policy solutions that could be used to achieve environmental goals,

including the future implications of not acting and the future benefits of following particular pathways to achieve the goals. The theory of change for GEO further supports a wide range of actors, including national governments, to make progress towards achieving the SDGs. This can be facilitated by embedding the findings of GEO into the 2030 Agenda policy process and implementation. With the GEO-6 report launched, GEO's theory of change has been refocused on other activities such as capacity building and thematic or regional knowledge products that have also been an integral part of earlier GEO cycles and play a role between global assessment reports.

3.3 Global science-policy-*society* interface

In order to exercise influence and achieve impact according to a theory of change model, assessments must constructively engage with target audiences and processes where significant environment-related decisions are being made. The target audiences for GEO are discussed in detail in Section 7 of this Background Paper. While traditionally engagement meant interaction between scientists and policymakers (the science-policy interface), there is a recognition that this alone may lead to an 'artificial closure' of understanding peoples' vulnerabilities and alternative views. A convincing case is being made for integrating a wider range of social groups and interests in the governance of science to realize 'technologies of humility' that recognize not only a wider diversity of social needs, interests and capacities but also different types of evidence and ways of knowing (Jasanoff 2007, Jasanoff 2005, Urbinatti et al. 2020). Hence the need to consider in assessments the interface not only with policy, but also society, in processes of co-creating knowledge and open exchange.

> ***Interview Comment***
>
> *We need to send the message to as many end-users as possible, not only to the policymakers, but all the wide spectrum of users… I don't think we should care about filling the gap of science and policy, we want to get the message across to everyone.*

The mapping of science-policy-society interfaces at the global level singled out three areas that are particularly relevant for global environmental assessments in general and the future of GEO in particular.

First, the 2030 Agenda for Sustainable Development is currently the highest-level global policy framework with an integrated perspective, implementation strategies and reporting mechanisms that include the environment. GEO, as an important part of this policy interface, was explicitly acknowledged in UNEP Resolution, UNEP/EA.4/L.27: Preambular paragraph.

Recalling the outcome document of the United Nations Conference on Sustainable Development, entitled "The Future We Want", in particular paragraph 88 (d), which called for the Environment Programme to "[p]romote a strong science-policy interface, building on existing international instruments, assessments, panels and information networks, including the Global Environment Outlook, as one of the processes aimed at bringing together information and assessment to support informed decision-making".

There are three specific global science-policy interfaces within the context of the 2030 Agenda for Sustainable Development:

- the ongoing assessment of global and regional progress on achieving the SDGs, which includes, but not limited to the Global Sustainable Development Report (GSDR);
- national reporting on SDG progress; and
- assistance to member states on development planning for mainstreaming and accelerating the SDGs and leaving no one behind.

Second, the UN Environment Assembly, the Rio Conventions and the landscape of global environmental assessments are the core science-policy-society interface for GEO. This interface was emphasized in a series of resolutions such as UNEP/EA.4/L.27, para (6) which "*Requests the Executive Director, in accordance with UNEP's mandate to keep the world environmental situation under review, to prioritize within the Programme of Work and Budget, the preparation of an options document for the future of the GEO process…*"

The global science-policy interfaces relating to the environment that will require coherence and coordination going forward include a very diverse set of institutions and initiatives, such as :

1. UN Environment Assembly: Periodic review of the world's environmental situation and annual reporting to the UN Environment Assembly.
2. UNFCCC: Coherence with the assessments, outlooks, and science-policy interfaces of the IPCC Assessment Reports
3. CBD: Coherence with the assessments, outlooks and science-policy interfaces of the CBD's Global Biodiversity Outlook and the Intergovernmental Science -Policy Platform on Biodiversity and Ecosystems Services (IPBES) assessment reports
4. UNCCD: Coherence with the assessments, outlooks and science-policy interfaces of the UNCCD's Science-Policy Interface body (via serving on panel or as observers) and its flagship report, the Global Land Outlook
5. The Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (the Regular Process): Coherence with the assessments.

The third interface involves multilateral environmental agreements (MEAs) whose relevance was recognized in resolution UNEP/EA.4/L.27, para (10), as referenced above. According to InforMEA (https://www.informea.org/), there are 44 global and 54 regional multilateral environmental agreements (MEAs) and protocols. In contrast to this total of 98, the World Trade Organisation states that there are more than 250 multilateral environmental agreements (MEAs) dealing with various environmental issues that are currently in force (WTO 2021). Annex 1 shows the global agreements using the InforMEA categories: Biological diversity; Chemicals and waste; Climate and atmosphere; Environmental governance; Land and agriculture; Marine and freshwater.

MEAs are typically focused on well-defined environmental issues and many have their own assessment and reporting mechanisms. The interaction of MEAs with global assessments such as GEO is bidirectional: they may contribute MEA-specific perspectives, data and analysis, but also benefit from the representation of their issues in other assessments. As the most comprehensive

global environmental assessment, GEO is in a unique position. Even though the scope of GEO evolves over assessment cycles, due to its generally broad coverage and through interactions with Secretariats, it ensures there is an interface with most MEAs. Realizing the potential of a science-policy-society interface requires not only thematic overlap but also cultivating the relationship with the actors engaged in MEAs during the assessment process.

Besides the interfaces discussed, assessments can also inform UN bodies involved in foresight-related activities. One specific example is UNEP's interface with the UN's High-Level Committee on Programmes (HLCP) under the Chief Executives Board for Coordination. The HLCP serves as a platform for interagency coordination related to common global goals, follow-up to major international conferences and sharing of best practices related to program development, implementation and monitoring. UNEP has been responding to calls for contributions by the HLCP's Informal Strategic Foresight where its work on early warning and assessment through GEO and GEO-related spinoff products are particularly relevant.

3.4 Global environmental assessment landscape

There is a wide range of global environmental assessments (GEAs). They include assessments published by already existing agencies such as UNEP, UNDESA and the OECD, assessments for multilateral environmental agreements (e.g. UNCCD, CBD, UNFCCC, Vienna Convention for the Protection of the Ozone Layer), or institutions created with the aim to assess the state of the research/knowledge, such as the Intergovernmental Panel on Climate Change (IPCC), the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (the Regular Process) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Important recent additions to the assessment landscape are the Global Sustainable Development Report (GSDR), and the Secretary-General's Report on Sustainable Development Goals. There is no grand overall design of the GEA landscape; while some of the assessments are tied to MEAs, the landscape as a whole developed incrementally. Most of the assessment processes produce additional outputs, such as specific reports summarizing methodological approaches (e.g., IPCC), reviewing trends in the past reports (e.g., GSDR), technical series (e.g., CBD Global Biodiversity Outlook (GBO)), and synthesis reports (e.g., UNEP Global Chemicals Outlook).

Most of the GEAs focus on one central thematic issue, such as the IPCC on climate change, IPBES and the CBD's Global Biodiversity Outlook on biodiversity and related issues, and UNEP's Global Chemicals Outlook on chemicals. The OECD Environmental Outlook focuses on multiple issues that are similar to GEO, but more narrowly relevant for OECD member states. Many of the reviewed GEAs include all of the elements presented in GEO: state and trends, impacts, policy analyses and scenarios. The "state and trends" cover past, current, and potential future trends to 2030, 2050, or even 2100. These assessments of state and trends investigate the GEA's focus areas, in some cases, combined with assumptions about economic and social development (e.g., IPCC, OECD Environment Outlook). Finally, many assessments develop a baseline and often a business-as-usual scenario. In addition to these scenarios, the GEAs include alternative scenarios of different emission pathways, degree of warming, a summary of existing alternative scenarios, and a sustainability transition pathway. Early warning is limited to certain types of GEAs, and, in the rest, some aspects of early warning are listed in the narrative of the report but without specific links to model outcomes. Synergistic policy options, bringing together the focus areas of the GEA with other sectors, are an important part of the reviewed GEAs.

Recent characterizations of the GEA landscape point out changes in political and institutional orientations (e.g., emergence of integrated goals), growing MEA epistemic and process complexity and a shift from diagnostic to solution-oriented assessments (Jabbour and Flachsland 2017; Kowarsch and Jabbour 2017). Research to analyze the evolution and characteristics of the GEA landscape has also considered a number of criteria to characterize the fit of GEAs in the assessment landscape in the 2015-2019 period. These included the demarcation of issues, relationship to agenda shaping, the contribution to defining policy goals and targets, suggesting potential policy interventions and instruments and monitoring progress (Maas, Kok and Lucas 2020). Research carried out for this background paper focussed on seven GEAs (IPCC; UNEP Emissions Gap; OECD Environment Outlook; Global Sustainable Development Report (GSDR); IPBES; Global Biodiversity Outlook (GBO); and Global Chemicals Outlook) for analysis to serve as a basis of comparison and consideration as options for the future of GEO are developed.

> ***Interview Comment:***
>
> *How does GEO fit in the Global Environmental Assessment landscape? Poorly, is the short answer to that. There are various answers to the question of why and I think those need to be explored.*

3.5 Selected functions

The place of an assessment in the GEA landscape is inherently connected to the assessment's functions, so the discussion will integrate the two. GEO has been an early and integral part of the GEA landscape, its role demarcated by its functions. While some of GEO's functions have been constant (e.g., the need to inform UNEA and previously UNEP's Governing Council), others have been evolving (e.g., the emphasis on goals, following the adoption of the MDGs and later the SDGs). The sections below outline the functions of GEO based on the understanding of its current role and based on what we know about the functions of GEAs in general. For a more definitive analysis, options for a future GEO will need to be elaborated and agreed, and assumptions about how the future GEA landscape will evolve would need to be made.

Informing UNEA. A central function of GEAs is rooted in their obligation to meet the expectations of their mandating body. In the case of GEO this body is UNEA (former Governing Council) and the expectation is to report on the state, trends and directions of the global environment, as defined by a series of UNEA resolutions. As UNEA is the highest-level global institution on the environment, this puts GEO in a strong position, as in principle it has the attention of key environmental decision-makers in national governments. As long as the mandate for future GEOs is renewed, this central function will continue.

Supporting policy planning, implementation and review at global and sub-global levels. Resolution 4/23 of UNEA formulates the mandate of GEO as: "Recognizing the potential benefits of a scientifically sound and evidence-based detailed assessment of the state of the environment to raise awareness and inform policy formulation and decision-making in the context of sustainable development". It requests the Executive Director of UNEP to continue to provide information from existing and ongoing assessments to guide future policy debates at the United Nations Environment Assembly. It should be noted, however, that since GEO covers a

wide range of issues and their interactions in the global report, it is often even more selective than most other assessments. Many policies that are of interest to the core target audience are at the national and subnational scale, but the global GEO can go into such details only very selectively.

Many of the other GEAs explicitly indicate that their focus is to support/provide information for policymakers. The often publish summaries for policymakers (e.g., IPCC, IPBES, IRP, Global Chemicals Outlook), which are carefully timed and synchronized with the corresponding policy cycle. The timing of GEO is discussed in a later section of this paper. The policy analyses focus on a combination of summarizing potential policy approaches, for example, to address climate change (IPCC), achieving the Sustainable Development Goals (SDGs) (UNEP Emissions Gap) and promoting sustainable development efforts at the global level (GSDR) and land and biodiversity management policies (IPBES). In some of the reports, policy analysis is only provided for selected policy examples, such as the implications of technology-related policy options (OECD EO), public–private partnerships, fishery policies, and public engagement (CBD GBO). GEO could aim to fill critical gaps left by other GEAs, such as consolidating the policy messages from prominent GEAs and then providing an analytical assessment to connect the dots. GEO could also provide a platform for the analysis of risks and benefits of policy options. Furthermore, in order to support the theory of change (see Section 3.2) GEO could also monitor policy changes and impact of GEO on environment, society and development.

Advancing and demarcating integrated, systems-based perspectives. Most GEAs are focused on a specific set of issues. There are only a few, such as the OECD Environment Outlook, that have a broad scope similar to GEO. While the thematic breadth represents a potential challenge and trade-off with the depth of analysis, it also represents an opportunity for GEO to analyze broader, systemic interactions that are off topic for narrow assessments. This is also linked to the shifting demarcation pointed out by Maas, Kok and Lucas (2020) that suggests a new framing for environmental governance is emerging that more explicitly recognizes that problems are embedded in the workings of environment and society. Adopting an inherently systemic perspective that is not bound by the issue framing of an underlying MEA can be not only a risk but also an advantage, as it can diagnose problems and find solutions at the intersection of indirectly connected issues, whether those connections are spatial, temporal or vary by actors. In this way, the systemic perspective of GEO could identify and evaluate the complex and multidimensional cause-and-effect relationships between society and the environment. Beyond taking a systems-based perspective, GEO can also play the important role of looking at emerging issues from different perspectives and thus reframe the debate on old and new challenges.

> ***Interview Comment:***
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> *If GEO is to have a future, it must go a step further than the IPCC and IPBES and others…. It needs to be an integrative machine. This integrative machine must have more impact than the individual machines of the individual (thematic) assessments….*

> ***Interview Comment:***
>
> *Then we have the IPBES, we have the IRP, but we need to look at how these interact with each other. How do they impact the global environment situation as a whole? And that is the kind of analysis that we are looking for.*

While all GEOs so far have covered a wide range of environmental issues, many also had a special thematic focus that had both science and policy resonance e.g., the green economy or the environmental dimensions of the SDGs. Besides maintaining attention to persistent issues across multiple assessment cycles, the flexibility of GEO to also focus on timely and highly relevant, cross-cutting issues considered through a systemic lens (e.g., post-COVID green recovery) can be considered a unique niche and key purpose of a GEO. Furthermore, GEO could demonstrate systemic approaches towards transformative environmental governance through providing examples of transformative processes that are taking place and discussing further steps to support systemic transformation.

Leveraging other assessments and UNEP work. There is now a vast number of integrated environmental assessment processes at global, regional and local level. Only the Global Sustainable Development Report explicitly mentions using GEO as an input to its assessment. The Regular Process and World Ocean Assessment is notable, inasmuch as it has no mandate to analyze policies and make policy recommendations. Although some of the assessments draw connections to other assessment processes, not all of them do. Furthermore, most MEAs require significant amounts of national reporting, many on an annual basis. While this reporting puts a huge burden on national institutions, the reports are a potential source of information for assessment processes, including GEO.

> ***Interview Comment:***
>
> *GEO is housed in a division and run with an outside multi-stakeholder process, intergovernmental, when the rest of UNEP is also doing amazing assessment work. These are outside of the GEO process. How is GEO bringing this in? And how are other assessments being done with GEO in mind? How do we get a hold of UNEP? This is a founding mandate for an institution, it is supported to be a whole of institution, not one division. How do we run an internal process for GEO that draws on everything else that UNEP is doing? How do we leverage that, how do we complement it? To get the richness and totality of what is being invested in UNEP, and not just invested in GEO.*
>
> ***Interview Comment:***
>
> *We were developing GEO and the Global Chemicals Outlook 2 at the same time, so these connections were not really happening as strongly as they should have. When the time came to build these bridges they did not really happen. The narrative of certain chemicals' aspects in GEO is not really the narrative of the GCO. That connection/bridge/glue needs to be better.*
>
> ***Interview Comment:***
>
> *…the plethora of assessments that are existing, not only in terms of state of the environment reports at national and regional level, … but also sectoral reports and thematic reports or issue-based reports. GEO should not try to compete with those … It*

should give space for those and become the meta-assessment, by which it would draw on already existing knowledge and information which is being created by these other rigorous processes and connect them together, create the added-value of bringing all together.

Formulating, implementing and assessing progress towards global environmental goals. Resolution 4/23 of UNEA requests the Executive Director of UNEP to strengthen the policy relevance of the Global Environment Outlook process by measuring progress towards the achievement of internationally agreed environmental goals, to inform relevant global processes and meetings. While the mandate does cover an evaluation with respect to measuring progress towards internationally agreed environmental goals, it remains ambiguous with respect to evaluating the effectiveness of national responses.

For the *Secretary General's SDG Progress Report* on the implementation of the 2030 Agenda, UNEP is the custodian agency for 26 Sustainable Development Goals Indicators and has the mandate to collect and report data for these indicators to the United Nations Statistical Division. In total there are 93 SDG indicators that are related to the environment. This tracking is reported through the World Environment Situation Room (WESR), through the Sustainable Development Goals Policy Briefs (https://environmentlive.unep.org/sdgpolicybrief). According to the latest brief, as of October 2019, 68% of the environment-related SDGs did not have sufficient data at the global level to assess progress.

The publication "Measuring Progress: Towards Achieving the Environmental Dimension of the SDGs" is a derivative product of GEO-6 (UNEP 2019a). It is viewed as a complement to GEO and provides an overview of the progress towards achieving the environmental dimension of sustainable development based on the SDG indicators.

Published in 2019, *The Future is Now: Science for Achieving Sustainable Development* is the first version of the Global Sustainable Development Report (GSDR) that was prepared by an Independent Group of Scientists appointed by the United Nations Secretary-General. The introductory material of the 2019 GSDR points out that this report is distinct from, and complementary to, the annual Sustainable Development Goals progress report prepared by the Secretary-General, which tracks progress across goals and targets using indicators from the global indicator framework. The GSDR largely builds on the results of other pre-existing assessments. It highlights state-of-the-art knowledge for transformations towards sustainable development and identifies concrete areas where rapid, transformational change is possible. The GSDR draws upon an extensive and diverse knowledge base, including the GEO-6 regional assessments.

Data, data interpretation and use in assessment. The BellagioSTAMP principles state that 'sustainability assessments are based on reliable data, projections and models to infer trends and build scenarios" (IISD and OECD 1997). This formulation is a very close fit for integrated environmental assessments (IEA) and GEO. Data are the lifeblood of integrated environmental assessments and provide the evidence base for the analysis, without which IEAs lose much of their scientific credibility. But the reverse is also true – without assessments, data have limited value. Assessments put data into context, find their meaning, and package them in a format that makes sense for audiences. Data are essential for tracking environmental progress, evaluating policy performance, assessing risk and impacts, and planning transition pathways to agreed goals and targets. Making sense of data is therefore an important function for GEO, although not for its

own sake – as is often heard in GEO circles, the assessment is data-oriented, but not data-driven. Environmental phenomena should not gain in importance because data related to them are available, but because they are materially important for the functioning of ecosystems and for human well-being.

In order to derive meaning, data are also used to construct indicators. Throughout its history GEO had several attempts to construct definitive indicator sets, but the results did not last. Reporting on megatrends does require well-defined indicators, but in their regional and thematic sections, GEO reports required more nuance and flexibility and typically relied on data and indicator sets that are most relevant and available in the given context. GEO is thus pragmatic about indicator use and uses indicators most relevant for assessing a given issue, while also taking the indicator's relevance from the policy point of view into account. At present this elevates the importance of indicators directly linked to the SDGs or goals and targets agreed in various MEAs.

Like several other global assessments, GEO is not involved in primary data collection, but it is a user of all types of environmental and environment-related data collected by others, whether statistical, geospatial or qualitative. Given its reliance on and sensitivity to problems with data of all types, GEO has a deep connection and long history of relationships with environmental data providers and monitoring networks, such as the GRID network, the Group on Earth Observations, and a wide range of national agencies that are in charge of collecting statistical and geospatial information. GEO not only makes use of environmental data in assessments, but also provides feedback to monitoring organizations on what data are actually needed for IEA and what are key data gaps or quality problems. Improving the targeting of primary data collection and monitoring systems is therefore an important function for GEO.

Projections from integrated assessment models represent a special class of data. Model data are essential for the outlook sections of GEO. Given the uncertainties associated with models and assumptions, the use and presentation of model data require special care. As long as transparency about model-based data is maintained, the integration of retrospective and forward-looking data can be a key asset for GEO.

In order to facilitate access to data primarily for the assessment community but later also for the broader audience of the GEO report, GEO embarked on building on global and regional data portals. A global GEO Data Portal was developed around 2000 and maintained by UNEP/GRID-Geneva to facilitate access to all types of reliable, harmonized and policy relevant data for Collaborating Centers involved in the global or sub-global GEO reports. The main output of the GEO Data Portal was a searchable database of statistical and geospatial data. The Portal was supported by a Data Working Group. GEO Collaborating Centers helped with data verification and facilitate access to verified regional data. In practice, the use of the GEO Data Portal in producing GEO reports remained limited, as authors found it better to make use of data from peer-reviewed publications that could be referenced.

Built during GEO-5 and making use of the experience with the GEO Data Portal, UNEP Live, later named "Environment Live" and presently named the "World Environment Situation Room" (WESR), is technically more advanced, although in terms of key functions it follows a similar

logic. Given GEO's core mandate and reliance on authenticated, reliable data, maintaining an online, continuously updated, interoperable database in some format is a must for the future of GEO but also represents an opportunity for a product and service that has value on its own and requires collaboration among many data providers and data users.

Access to and analysis of projections from thematic and integrated models and scenarios. The use of integrated models—or at least bringing together results from different integrated models—is a common feature of GEAs. The models are generally used to make projections into the future but can also be used to provide a deepened understanding of cross-sectoral interactions. Integrated Assessment Models (IAMs) are commonly used to examine interactions between human activities and the environment and also to test the impacts of policy measures. The results from models have been used in the some GEAs (e.g. IPCC, IPBES, OECD EO) to provide early warnings of impending problems, e.g., the increasing number of heat waves, the rise of sea level in low-lying coastal areas, and the impacts of climate change on agricultural yields. In this respect, the use of models contributes to the assessment process by synthesizing large amounts of data to provide useful information for decision-making.

Many of the GEAs studied for this paper use scenarios to explore plausible developments in the future i.e., what could happen. Since it is impossible to predict the future, even with the best models, scenarios are a valuable tool for exploring uncertainties and their possible consequences. GEAs often use a baseline scenario that essentially describes the current situation and then develop scenarios for points of time in the future (2030, 2050, 2100). Business-as-usual scenarios describe what happens if developments continue along their current trajectory, various socio-economic scenarios describe what happens if developments follow different trajectories, emissions scenarios explore the impacts of different levels of ambition in reducing emissions of greenhouse gases, etc. Since GEO-4, GEO has not itself developed and used a set of scenarios to explore possible developments in the future. Other methods have been used instead.

> ***Interview Comment:***
> *The key word in GEO is the outlook… Global Environmental Outlook should be forward-looking*

Risk assessment is included to varying degrees in the GEAs reviewed for this paper. While risk assessment is one of IPCC's core objectives, the rest of the GEAs primarily present specific examples related to disaster risks (GSDR, UNEP Global Chemicals Outlook) and risks to biodiversity and species extinctions (OECD EO, IPBES). All of the GEAs reviewed for this paper focus on identifying synergistic policy responses to connect the assessment focus areas with other sectors, such as agriculture, urban planning, water management, integrated natural resources management, and human rights. In this context, the defined sustainable development pathways/transition pathways mostly present routes to achieve/maximize these synergetic policy options. In terms of key levers, primarily economic development, governance systems, finance, and education are covered by the GEAs that have been reviewed.

Contribution to capacity building. Decision 18/27 A of 25 May 1995 (UNEP 1995) that provided its mandate explicitly mentioned that GEO has a role in "promot(ing) the development of data and information management capacity in those bodies situated in developing countries as necessary and appropriate to ensure their full participation" in the assessment. IEAs are complex processes that require specialist knowledge and experience. They also require access to other aspects of capacity such as information, tools and resources, not necessarily a problem for some

of the leading international institutions involved in GEO. However, as a global assessment that took regional participation and legitimacy seriously, GEO by definition had to involve partners whose IEA capacity was limited. As early GEO planning documents show, capacity gaps were known and expected (Bakkes et al. 1998). Tackling them was framed as an integral function of the assessment: the practice of 'learning by doing' coupled with targeted capacity building was seen as a way to bring along and strengthen IEA capacity in those corners of the world where such capacity was lacking. Thus, one of the functions of GEO is to strengthen worldwide capacity to improve the quality of contributions to the global GEO.

As GEO's capacity building programs started in earnest around 1997, it became clear that there is another, even more significant audience. Target audiences of IEA capacity building and training were interested not only in contributing to the global GEO, but rather in initiating and contributing to their own sub-global – regional, national, ecosystem, or even city-level – IEAs. As a result of these efforts, starting from GEO-2000 several iterations of GEO training manuals and guidelines were prepared in both print and e-learning format, and a large number of sub-global IEA processes were conceived (Pinter et al. 2000; UNEP and IISD 2007; UNEP 2019a). Capacity building was focused not simply on assessment methods but establishing and managing the entire assessment process, which is what many governmental and other partners were interested in. In addition to training, another important capacity building modality involved the recruitment of junior experts as interns, who worked as contributors to global GEOs and were recognized as authors.

The precise number of training events and number of participants over the lifetime of GEO has not been systematically tracked and it is not known. However, available meeting documentation confirms dozens of training events focused mainly on developing countries took place in Africa, Latin America, the Asia-Pacific region, Eastern Europe and West Asia since the publication of the first IEA training manual in 2000. All modules in the IEA Training Manual were converted into e-learning format, and a global training of online trainers was held in Panama around 2008. Recognizing that capacity needs were diverse and capacity building events and activities that made use of the same GEO materials were being organized by a growing number of actors and in many locations, a web-based IEA Community Platform was developed by UNEP and IISD. The Platofrm was maintained until about 2010 as a repository of training materials, and connecting qualified and aspiring trainers, keeping track of capacity building events and activities and sharing of lessons learnt. While the impacts of years of GEO and IEA capacity building activities have not been systematically evaluated, one possible metric of their significant contribution is the major spike in the number of IEA reports following the GEO approach published by regional and national entities particularly in the 2000-2010 period that coincided with the rollout of the GEO capacity building program.

One relevant insight from years of capacity building experience in GEO is that capacity building requires sustained effort. Building real capacity also requires real investment. While there are clearly capacity issues associated with the global GEO reports, capacity building can also target the regional, national and even local level, and contribute to launching IEA processes in the GEO mould. The GEO training program was an early adopter of e-learning, and while its distant learning version was never put to full use, the relevance of this direction was made even clearer

during the COVID crisis. As the development of several former junior scientists who participated in GEO interns into high-profile IEA experts who continue involvement in GEO indicates, internships represent another important route for developing capacity in well-targeted disciplinary areas.

Capacity building is likely a continuing interest both in the context of the global assessment and at the regional and national level. Addressing these needs through involvement in the global process or more targeted action using face-to-face or online materials and programs and through other means like internships as done in earlier GEOs and by other global assessments is likely a relevant consideration for future GEOs.

4 Assessment governance

Key messages

- For the future of GEO, it would be important to clarify whether to continue with the current governance and implementation system or to move towards a system of network governance and to change the formal structure.
- Governments play various roles in global assessment processes and are also the primary – even if not the only - audience for the results of the assessments.
- The representation of member states and non-academic stakeholders in specific stages of an assessment process is one key mechanism for enhancing the legitimacy and relevance of the process and outputs.
- Partnerships with collaborating institutions can be seen in several global environmental assessments as a mechanism for enhancing capacity and connecting with stakeholders.
- Both the IPCC and IPBES have substantive Technical Support Units to enhance capacity of the assessment processes. The TSUs are separately funded by the governments and have a large role to play in ensuring the content of the assessments is of high quality.

4.1 Overall Governance and implementation Structure

The UN Environment Assembly, the primary audience for GEO, is the world's highest-level decision-making body on the environment with representation from all 193 member states. It is also the governing body of UNEP, whose Secretariat oversees the GEO process.

The governance of the working structure of GEO-6 is illustrated in Figure 2. The High-level Intergovernmental and Stakeholder Advisory Group (HLG) ensures that the mandates, scope and process of GEO-6 are fully realised within the implementation plan and where necessary, provide recommendations to the Secretariat on ways to improve both methodology and content (UN Environment 2020a). The latter function carried out in consultation with the Assessment Methodologies, Data and Information Working Group, whose key mandate is "to provide guidance on assessment methodologies and to guide the overall quality assurance of data and information flows." A Scientific Advisory Panel (SAP) was also established for GEO-6 "to guide the assessment process and to ensure scientific credibility and overall quality and integrity of GEO-6." Lastly, an Interagency GEO Support Group was established to "provide technical support and interagency coordination during the GEO-6 assessment process."

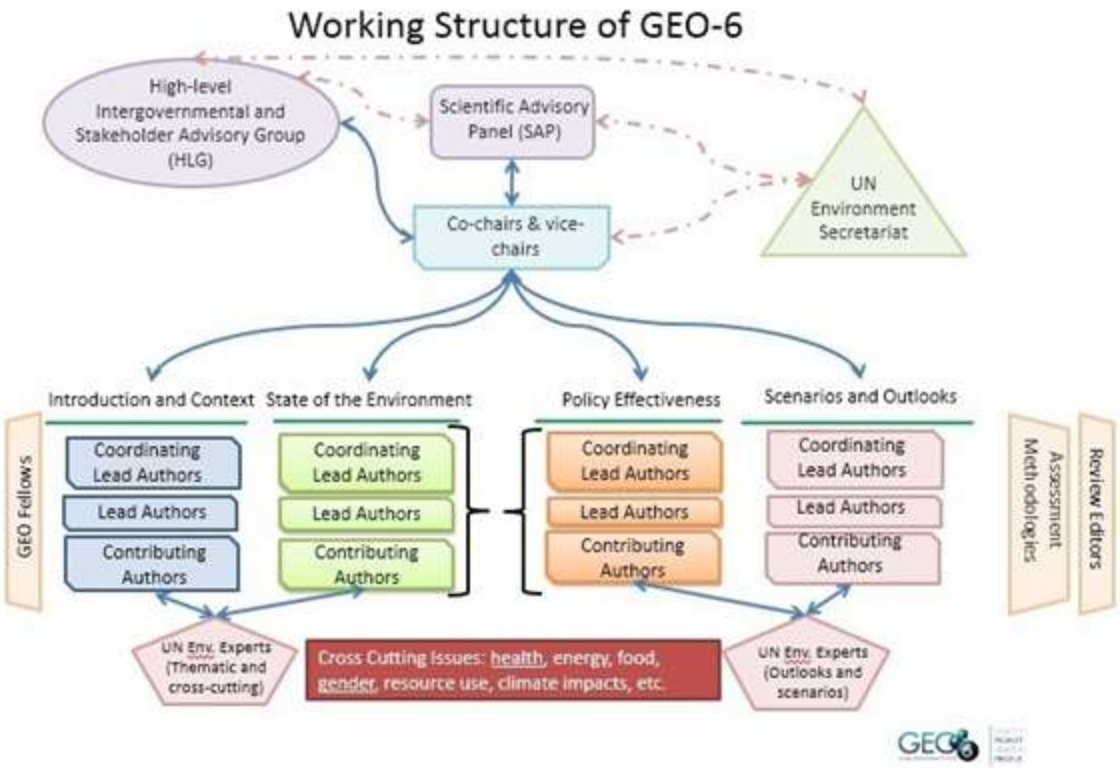

Figure 2: Governance of GEO-6 (UNEP 2019).

UNEP (2019a) notes that the GEO-6 working structure "is different from GEO-5 in that it includes Co-chairs and Vice-chairs", a structure that was recommended by the Scientific Advisory Panel to "help ensure the scientific credibility of the GEO-6 process." It is further noted that this structure serves to incorporate "guidance on policy relevance from the High-Level Group, Co-Chairs and Vice Co-Chairs who will act as a bridge between the authors and advisory bodies."

While not shown on the governance structure of GEO-6, UNEA serves as an oversight body of UNEP, including GEO. UNEA meets every two years, and in intersessional periods it supports UNEP's work through a Committee of Permanent Representatives (CPR). The CPR is therefore also an important part of UNEP's assessment governance framework. Details about the CPR are provided in Box 1 below.

Box 1: UNEA's Committee of Permanent Representatives

The UNEA is advised by a subsidiary body, the Committee of Permanent Representatives (CPR). The CPR convenes as a subcommittee in order to: provide policy advice to the Assembly; contribute to the preparation of UNEA agendas and the draft decisions it will consider; and oversee the implementation of resolutions and the programme of work once they are adopted. The role of the CPR in preparing the draft decisions should be kept in mind when thinking about how to move a global assessment finding into a decision at UNEA. The release of an assessment and briefings on GEO findings should be timed for the CPR's preparation for the Assembly, and not wait until the Assembly itself (Gehring and Ruffing 2008).

In comparison, the overall governance of the IPCC's Assessment Report, the IRP's Global Resource Outlook and UNEP's Global Chemicals Outlook, for example, differ in some interesting ways. The IPCC Assessment report (Figure 3) is served by a governance and implementation structure supported by the Secretariat of the IPCC, which "promotes and maintains cooperation with the UN system, in particular with the UNFCCC and other relevant bodies, and liaises with the two parent organizations, the World Meteorological Organization (WMO) and UNEP" (IPCC 2020a). Specifically, the Secretariat manages the IPCC Trust Fund consistent with WMO regulations and rules and ensures the IPCC work programme is implemented consistently with relevant UN and WMO regulations and rules (IPCC 2020a). The IPCC Plenary currently has 195 members who make decisions regarding election of the Bureau, the workplan and budget, and scope and approval of assessment reports. Furthermore, four Technical Support Units (TSUs) "provide scientific, technical and organisational support" to the three IPCC Working Groups and the Task Force on National Greenhouse Gas Inventories. These are currently served by a mix of academic institutions and environmental NGOs.

In response to a 2010 review requested by the IPCC Chair and the Secretary-General of the UN and conducted by the InterAcademy Council (IAC), the Plenary Panel "decided to establish an Executive Committee to strengthen and facilitate timely and effective implementation of the IPCC programme of work, strengthen coordination between Working Groups and Task Forces and to address urgent issues that require prompt attention by the IPCC between Panel sessions (IAC 2010)." As rationale for this additional governance element, the review noted that "the complexity and scale of climate change research and the associated assessment task have grown significantly over the last two decades, as have public expectations regarding the assessments. Yet the fundamental management structure of the IPCC has remained largely unchanged (IAC 2010)." The main bottleneck cited was that the Plenary Panel and the Bureau made their decisions at annual sessions, whereas important decisions needed to be made more than once per year. The membership of the Executive Committee includes the IPCC Chair, Co-chairs of Working Groups and the Task Force on Inventories, the IPCC Vice-Chairs, elected Advisory Members, Head of Secretariat, and the four Heads of the Technical Support Units.

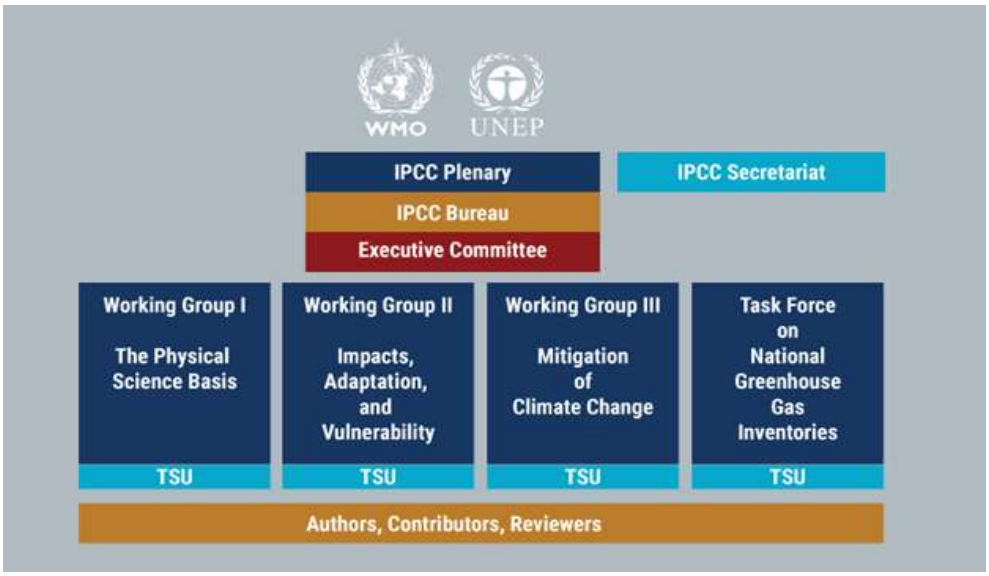

Figure 3: Governance of the IPCC Assessment Report (IPCC 2020a)

The International Resource Panel (IRP) was launched by UNEP in 2007 to build and share the knowledge needed to improve the use of resources worldwide (IRP 2020). The IRP is comprised of a Secretariat hosted by UNEP to coordinate administrative and operational functions, a Scientific Panel of 36 scientists to prepare assessments and a Steering Committee of 28 governments along with the EU and UNEP to guide the Panel's strategic direction, ensure policy relevance, help set the annual work plan, and oversee budgets (Figure 4).

The IRP's Strategic Partners "provide support in the development and dissemination of IRP publications, enhancing its policy and academic impact, and creating synergies with other relevant stakeholders, among others." The IRP's Strategic Partners include UN agencies, international, regional and national organizations, intergovernmental bodies, non-governmental organizations, private and public institutions, business and industry associations, research centers, universities, foundations, and science-policy platforms.

Figure 4: Setup and partners of the International Resource Panel (from IRP 2020).

The Global Chemicals Outlook II launched in 2019 deployed a simpler governance structure compared to the IPCC Assessment Report and the IRP Global Resources Outlook. The Global Chemicals Outlook II was prepared by UNEP's Economy Division, Chemicals and Health Branch (UN Environment 2019) and "through a process involving more than 400 scientists and experts around the world under the guidance of the Steering Committee of the Global Chemicals Outlook II with participation from all regions and a wide range of stakeholders. The report was developed in response to Governing Council decision 27/12, adopted in 2013, and United Nations Environment Assembly resolution 2/7, adopted in 2016" (UNEP 2020). The Steering Committee comprised representatives from governments, non-governmental organizations (including civil society, industry/the private sector, and academia) and inter-governmental organizations, with participation from all regions and a wide range of stakeholders (UNEP 2019).

> ***Interview comment:***
>
> *Knowledge creation nowadays goes beyond scientific inputs. Science is just one form of knowledge…. Is the future GEO purely based on a scientific approach or should we develop a governance system that is more multidimensional in knowledge creation?*

The governance and implementation structure of assessments like GEO-6, IPCC and IPBES have both elements of top-down (e.g. in regards of mandating and scoping) as well as elements of polycentricity (e.g. in regards of ensuring diversity and integrity) in their governance and implementation structures. A division of responsibility between science and governments, but also the representation of different regions and non-state actors in governing global assessments is key for their legitimacy and hence potentially contested. One approach for governance, coming from the business and organizational research community, is network governance, which can also be seen as a mode of collaborative governance or co-management. Figure 5 shows three archetypes of network governance, which could be used for an assessment process. The governance of earlier GEOs until GEO-4 that involved Collaborating Centers (CCs) was closer to a network governance model.

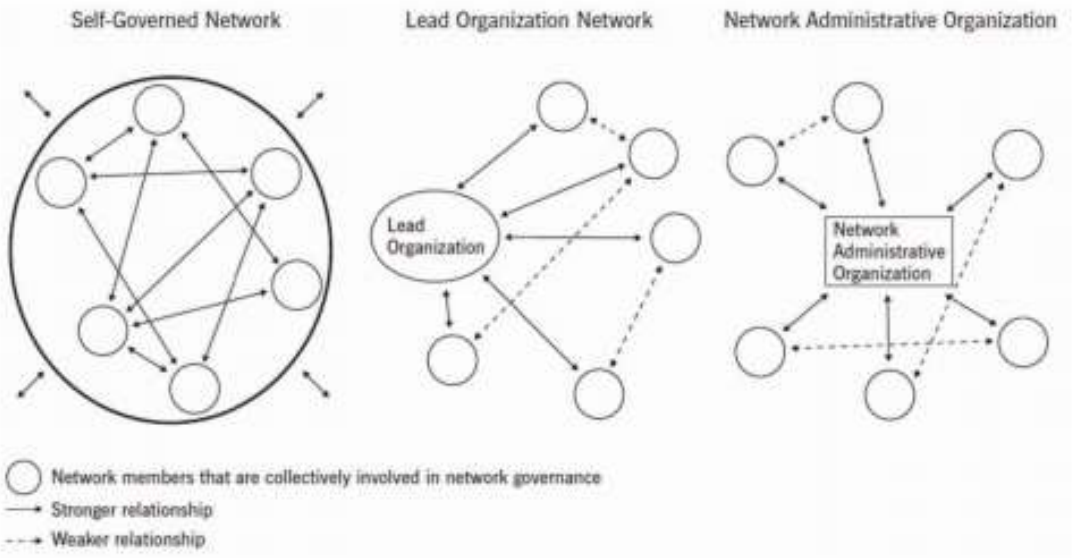

Figure 5: Three archetypes of network governance (Source: Greany and Higham 2018).

For the future of GEO, it would be important to clarify whether to continue with the current governance and implementation structure, or to change the role of the different actors, reach out to other groups of stakeholders, to further formalise it or to move to a network governance.

4.2 The Role of Governments

Governments play different roles in global assessment processes as illustrated in the overall governance structures cited in the above examples. In each example, governments oversee the assessment process through various structures including the High-level Group in the case of GEO-6, the Plenary Panel for the IPCC Assessment Report, and the Steering Committees for the International Resource Panel's Global Resource Outlook and UNEP's Global Chemicals Outlook.

GEO aims to synthesize knowledge on the state of the environment in a way that is salient (relevant) for policy development. In the current GEO process, salience is driven by a number of mechanisms including: GEO's mandate as provided by member states through UNEA, which further specifies the issue of the respective report; the High-level Group for a reporting cycle; national government representatives who are involved in the assessment process mainly in their role as reviewers; and the draft Summary for Policy-makers which is negotiated by representatives of the member states and prepared as a template for the UNEA Ministerial Conference.

Governments are represented through:

- membership in governance bodies;
- submission of requests for assessments, individually or collectively through intergovernmental bodies such as UNEA or the COPs of MEAs;
- participation and initiation of scoping of assessments, including in nomination of scoping experts, review draft scopes and approval of scoping documents;

- nomination of assessment authors and reviewers;
- review of draft assessments;
- line by line consideration and approval of summaries for policy makers in cooperation with the scientific authors of the assessment.

Of course, governments are also the primary audience for the results of the assessments, at least their most prominent global products, such as the main GEO reports. The Theory of Change for GEO-6 outlines this in describing the intended outcome of the assessment, noting that "…governments (and potentially other non-state actors) should understand the findings in order to use them to advance their policy work. Governments can also use the GEO methodology to prepare their own regional, national or sub-national assessments if desirable (UNEP 2019b)." Additionally, governments also play a core role in financing the global assessments, GEO included.

4.3 The Role of Science

Like any other integrated assessment, the credibility of GEO is measured first by its scientific quality. The selection of authors follows the principles of scientific excellence, disciplinary and regional diversity, while also aiming for gender balance. For GEO-6 this scientific expertise was allocated across four areas, namely: introduction and context, state of the environment, policy effectiveness, and scenarios and outlooks (Figure 2). For the IPCC Assessment Report, the role of science is partitioned across three Working Groups and one Task Force, whereas for the IRP's Global Resource Outlook a Panel of 36 scientists is assembled with internationally recognized skills in the harvesting of resources, production, consumption and recycling, and policy, economics and trade.

In GEO-6, an open nomination process was used for scientific and policy expertise, including by colleagues, the Secretariat, other UN entities, co-authors, as well as nominations by governments (UNEP Science Division, personal communication). Author teams were normally structured to have at least two Coordinating Lead Authors for each chapter with different types of expertise to balance divergent opinions and mitigate the possibility of bias (UNEP Science Division, personal communication). In terms of support, the IPCC and IPBES usually require that developed country authors are supported by their governments, whereas GEO supports the travel and participation of all of the authors (UNEP Science Division, personal communication). While authors were not remunerated for their time in GEO-6, their travel and a small stipend are used to compensate for any unanticipated expenses incurred (UNEP Science Division, personal communication).

> ***Interview Comment:***
>
> *Nomination of experts in IPBES is through a transparent call to strengthen legitimacy. Selection of experts is made by a multidisciplinary expert panel, who are approved by the plenary based on their scientific credentials.*

Five peer reviews were conducted for GEO-6 and a pool of review editors were brought in towards the end of the process to assess how completely and credibly the peer review comments

were dealt with (UNEP Science Division, personal communication). This was intended to help mitigate bias and increase the scientific credibility of the process. At the conclusion of the process the Scientific Advisory Panel was asked to send a letter to UNEP's Chief Scientist with their opinion on the scientific credibility of the GEO process (UNEP Science Division, personal communication).

The resolution on GEO encouraged the use of citizen science to close data gaps. In GEO-6, Chapters 3 and 25 examined the state and outlook of data, including citizen science, Indigenous and Local Knowledge (ILK) and big data. Each of these were found to have challenges to be addressed, i.e., citizen science suffers from authentication issues; the relevance of ILK outside the sphere of biodiversity; and the complexity of big data and applicability in the environmental domain (UNEP Science Division, personal communication). However, it is increasingly recognized that transitions to sustainability require more open knowledge systems that go beyond the engagement of scientists and some decision-makers. Furthermore, particularly in the area of biodiversity and ecosystem services, the need has been demonstrated for greater use of local and traditional or indigenous knowledge alongside conventional scientific knowledge in making decisions. In 2017, member states of IPBES adopted an ILK approach. Inclusion of diverse conceptualizations of sustainability is enabled through such approaches.

4.4 Mechanisms to Connect with Stakeholders

The representation of member states within assessments is one key mechanism for enhancing the legitimacy of the process and outputs, but legitimacy is also created through recognition of the process or through the participation of non-academic stakeholders (van der Hel and Biermann 2017). In GEO-6, the High-level Intergovernmental and Stakeholder Advisory Group had from eight to ten representative stakeholders serving throughout the process (UNEP Science Division, personal communication). These stakeholders came from representative groups defined in UNEP's Major Groups and Stakeholders process, including from industry, Indigenous peoples' organizations, environmental groups, civil society organizations, among others. The mechanism to connect with stakeholders in the International Resource Panel's Global Resources Outlook occurs via representation on their Steering Committee and through their formal Strategic Partners. For the Global Chemicals Outlook, stakeholders participated via the Steering Committee.

> ***Interview Comment:***
>
> *The role of major groups in this process has to be strengthened, they have to be equal parts of problem description. Better dialogue not only with governments but also major groups is essential. … For example, co-leadership of chapters or analytical fields could be a microcosm of this new form of governance: to have 2-3 from science, 1 from government and 2-3 from major groups in the analytical process.*

4.5 Partnership with Collaborating Institutions

Partnerships with collaborating institutions can be seen in several global environmental assessments as a mechanism for enhancing capacity and connecting with stakeholders. For the IPCC's Assessment Report, four Technical Support Units (TSUs) are engaged to increase capacity of the three working thematic Working Groups and its Task Force on GHG Inventories. These TSUs are collaborations with various academic institutions and environmental NGOs.

Prior to GEO-6, UNEP had used a similar, albeit less formally structured collaborating institution model to enhance capacity for undertaking the assessments and connecting with thematic and regional stakeholders. Collaborating centres, among other tasks, coordinated the GEO process at sub-global level, guided national-level contributions and ensured that the contributions provided quantitative data and were specific to the themes and issues identified during regional consultations. They also provided backstopping on development and population of indicators for online databases, providing interactive online tools to support integrated environmental assessment and reporting, as well as assisting in the capacity building of Member States in environmental assessment and reporting.

Interview Comment:

Engaging with a range of collaborating centers, you can actually define a research agenda for the intervening period between the global assessments. You would bring a huge partnership of research capability across the globe to generate the information that is necessary.

Interview Comment:

Another option is having the secretariat to work with technical support units elsewhere, keeping in mind that sometimes these also add to the burden, but it can also strengthen the partnerships

4.6 Secretariat Role and Capacity

In the GEO process, the UNEP Secretariat through the Science Division has provided technical support for the development process and mediated between authors and member states and their representatives (UNEP Science Division, personal communication). It monitors the process to ensure that the assessment remains in line with the mandate provided by the countries. In process design, the roles of the countries, the experts and the UNEP Secretariat are separated. However, while the Secretariat could fulfil its role for earlier GEO reports, the scope of the reports and associated activities have expanded considerably over time and the process has become much more complex. The mid-term evaluation for GEO-6 showed that while many respondents thought that the UN staff supporting the GEO process were doing the best job possible with existing resources, the administrative support available was not sufficient for the large number of participants in the complex process of regional and global assessments.

Interview Comment:

The secretariat function has to be split into organization-related and increasingly collaborative models.

For comparison, both the IPCC and IPBES both have Technical Support Units to enhance capacity of the assessment processes. The TSUs are separately funded by the governments and

have a large role to play in ensuring the content of the assessments is of high quality. The IPCC Secretariat in Geneva provides mostly administrative support, organizes meetings and manages the budget. In GEO's case, all of these functions are combined and performed by one Unit within the Science Division of the broader UNEP (UNEP Science Division, personal communication). Guidance on content is provided by only one professional staff member within this unit and administrative and logistics support is provided by a group of general service staff, consultants and UN Volunteers. As already noted, the GEO-6 mid-term evaluation believed that this was not sufficient for such a flagship product.

5 Assessment process and methods

Key Messages

- Assessments are designed to be perceived as credible, salient and legitimate by participants and users. There are different modes of assessment with different strategies to achieve this. Furthermore, trade-offs between these characteristics are possible.
- The selection of authors for future GEOs will depend on a number of factors, including the scoping and timing of the assessment, the availability of resources and whether the assessment aims to be transformative or only to report on the state of the environment.
- Depending on the assessment mode and authorship model selected, the administrative capacity and scientific expertise of the secretariat could be strengthened, or if that is not feasible, the GEO process could be simplified, so that the UNEP secretariat can provide the necessary support within existing resource constraints.
- The key question with regard to scoping is whether the assessment should have a narrow or broad focus.
- For the future of GEO, a decision needs to be taken on the summary for policy makers – the document could be drafted by the scientific authors, co-produced with policy makers, drafted by policy makers only or co-produced with other groups such as business and civil society. If policymakers exercise full control over its content through the negotiations, the document should be referenced as summary *by* policymakers, even if its initial draft is prepared by experts.

5.1 Codification of the assessment process

Studies of global assessment processes (e.g., Cash et al. 2003; Farrell et al. 2006; Mitchell et al. 2006) have highlighted that an assessment that is viewed as more salient, credible and legitimate to a particular assessment participant or user is more likely to change his or her beliefs and thus be effective. These determinants of the effectiveness of assessment processes are defined as follows (Cash et al. 2003):

- Salience: "the relevance of information for an actor's decision choices, or for the choices that affect a given stakeholder".
- Credibility: "whether an actor perceives information as meeting standards of scientific plausibility and technical adequacy".
- Legitimacy: "whether an actor perceives the process in a system as unbiased and meeting standards of political and procedural fairness".

The main process steps of an assessment are designed to ensure political relevance (saliency); ensure scientific quality and integrate different stocks of knowledge (credibility); and manage participation (legitimacy) and communication (Beck et al. 2014). It is important to note,

however, that “these determinants are often in tension, because the easiest ways of enhancing any single attribute almost invariably cause declines in another” (Farrell et al. 2006, p 10).

The core process steps of GEO are essentially assigned to these functions:

- The current GEO process to ensure salience includes: the scope and mandate is developed through an intergovernmental and multi-stakeholder consultative process and approved by the member states, which further specifies the issues to be covered; a group of representatives of the countries is set up as a permanent monitoring group for a reporting cycle (High Level Group, HLG); national administrations are involved in the assessment process mainly in their role as reviewers; the draft Summary for Policy-makers is considered line by line and endorsed by government representatives in an intergovernmental meeting with scientific authors who are responsible for the findings. The assessment findings approved by government representatives are presented to the UNEA Ministerial Conference. The member states then draft an assessment of the report and draw conclusions; and individual member states and stakeholders use the report to draw their own conclusions and generate further knowledge or start their own assessments.
- The credibility of the reports is achieved in particular through transparent peer review processes, a transparent handling of uncertainty and the assessment of scientific controversies. The selection of authors follows the principles of scientific excellence, disciplinary and regional diversity.
- The participation of member states in the scoping, review, consultation and coproduction of the summary for policy makers, together with the representation of states by UNEA and the HLG within GEO are central elements to ensure the legitimacy of the process and the report.

Van der Hel and Biermann (2017) have shown that there are three different modes of assessment to achieve salience, credibility and legitimacy (Figure 6). An assessment-oriented mode focuses on the scientific evidence and its integration, legitimacy is achieved by representation. This mode requires broad authorship and coordination. The advice-oriented mode seeks salience by independent advice, credibility through individual credentials and legitimacy through formal recognition. An example of this mode is the Scientific Advisory Board that advises the United Nations Secretary-General and the executive heads of UN organizations (Scientific Advisory Board 2014) or the International Resource Panel. This mode relies on a smaller group of authors with less demand for coordination. A solution-oriented mode combines strategies for salience by offering solutions, credibility through the community developing these and legitimacy through participation. This solution-oriented strategy is strongly reflected in the narrative of both the Sustainable Development Solutions Network and Future Earth (Sustainable Development Solutions Network 2016; Future Earth 2013). This mode requires the dedicated use of participatory processes with much less emphasis on the integration of published scientific results. The process currently adopted for GEO represents features from the assessment-oriented mode, but also some of the features from the other two modes. Although the examples referred to above are not assessments processes as such, they may inspire further thoughts on the future of GEO.

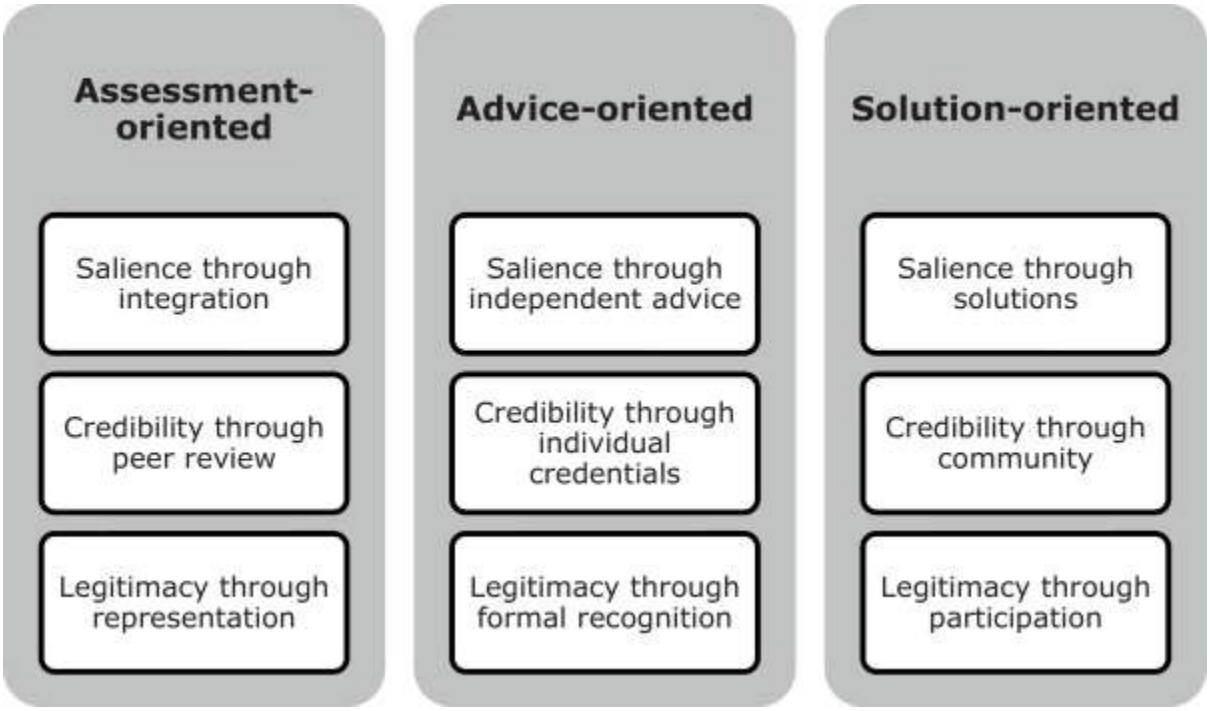

Figure 6: Three modes of assessment to achieve salience, credibility and legitimacy through different strategies (Source: van der Hel and Biermann 2017, p. 217).

A question for the future of GEO is, therefore, whether to continue with the current assessment process or to use different strategy and design to achieve salience, credibility and legitimacy.

5.2 Assessment contributors

As described in the previous section, authors and experts in the GEO-6 were selected after an open nomination process. Author teams are normally structured to have at least two Coordinating Lead Authors (CLAs) at the top of each chapter with different types of expertise (See also Figure 2, Section 4). This is meant to balance divergent opinions and mitigate the possibility of bias. The authors take on different roles according to seniority, ability and willingness to contribute and expertise. CLAs assume responsibility for a thematic chapter, coordinate the various authors, ensure consistency and quality and represent the chapter to external parties. Lead authors (LAs) prepare the text for the chapters. Contributing authors contribute specific parts of the text. The elaboration of the texts is coordinated by the CLAs together with the Secretariat.

For GEO-6, Coordinating Lead Authors (CLAs) coordinated writing teams for each section in the Global and Regional assessments based on the selection of Lead Authors by the Scientific Advisory Panel, in close consultation with respective CLAs, the Secretariat and the UNEP Chief Scientist.

The working structure of GEO-6 (see Figure 2 in previous Section) was recommended by the Scientific Advisory Panel to help ensure the scientific credibility of the process. The structure

incorporates guidance on policy relevance from the High-Level Group, Co-Chairs and Vice Co-Chairs who act as a bridge between the authors and advisory bodies and GEO Fellows whose role is to support the process by assisting the authors with research questions and performing quality assurance tasks for citations and references. The structure also considers Review editors who conduct evaluations at the end of each review period to ensure that review comments were dealt with appropriately. GEO-6 was produced by 250 scientists and experts from more than 70 countries.

> ***Interview Comment:***
>
> *We need to broaden the types of experts who engage in GEO. Historically we had an over-representation of natural scientists, that is necessary, but GEO needs to change its way of attracting and sustaining the engagement of social scientists.*

As with the design of the assessment process, there are alternatives with respect to the selection of authors. One alternative would be a standing panel of authors, possibly a mixed panel of policy practitioners and academics, analogous to the IRP. A smaller number of authors could be appointed to a panel on a permanent basis to write the report(s) and, in particular, contribute through their reputation. In this way, scientists could also be recruited who do not participate in the current GEO process because it does not provide visibility or scientific credits. A standing panel could also be supplemented by persons who are or have been involved as practitioners in policy development (also in analogy to the IRP). A standing panel could possibly focus on the policy evaluation (while other parts of GEO on DPSI could be provided as, e.g., a State of the Environment report).

A second alternative could be authors from scientific administrations or commissioned studies. Currently, the large number of authors is connected with a broad coverage of different disciplinary and geographical perspectives. However, it is also associated with high transaction costs for communication between the authors and between UNEP and the authors. In analogy to the State of the European Environment Report by the EEA, the Environment Outlook of the OECD or the Emission Gap Report of UNEP, the GEO report could also be written by members of the administration, possibly also within the framework of commissioned studies. If necessary, institutes or networks of institutes could also be commissioned to write the reports on the various topics or with a regional focus (e.g. appropriately equipped Collaborating Centres as it was the practice until GEO-4 or comparable to the EEA Topic Centres).

> ***Interview Comment:***
>
> *For the WMO State of Climate report and the Greenhouse Gas Bulletin, the assessments are expert-based, not an IPCC-style intergovernmental process. WMO relies on a number of global centers like the European Centre for Medium-Range Weather Forecasting or the Japan Meteorological Agency to ensure the scientific credibility. The assessment does not go through a vetting process by countries, high-level negotiations and discussion processes, but through the expert community.*

For a solutions-oriented assessment, it is argued that knowledge resources from non-academic actors must be integrated in order to understand complex or value-based problems and develop appropriate solutions (Tàbara et al. 2018). This could include, for example, contributions from development practitioners and field - level implementation experts. It could also involve developing and applying criteria to ensure experts with alternative worldviews (e.g., based on ILK) are included among the authors.

The current design of the GEO process and the division of labour between academic experts and representatives of the countries implies that the experts are expected to provide value-neutral facts and abstain from prescriptive statements. Insofar as an orientation towards solutions is expected, this is a problematic boundary definition, because in a solution-oriented assessment policy goals and instruments also become the subject matter. Edenhofer and Kowarsch (2015) propose that policy paths be investigated and that, for this purpose, a joint problem analysis, identification of options and evaluation of effectiveness be carried out jointly by experts and non-academic actors within the framework of environmental assessments (see also Edenhofer and Minx 2014).

The question for the future of GEO is, therefore, whether to continue with the assessment-oriented selection of authors, or to shift to alternative models for authorship. This will depend on a number of factors, including the scoping and timing of the assessment, the availability of resources and whether the assessment aims to be transformative or only to report on the state of the environment.

5.3 Role of the secretariat

In the GEO process, the UNEP secretariat has provided technical support for the development process and mediated between authors and member states and their representatives. It also monitors the process to ensure that the assessment remains in line with the mandate provided by the countries. In process design, the roles of the countries, the experts and the UNEP Secretariat are separated. However, while the Secretariat could fulfil its role for earlier GEO reports, the scope of the reports and some of the associated activities have expanded over time and the process has become more complex (see previous Section).

In particular with respect to the availability of resources in the next few years as a result of the COVID-19 pandemic, alternatives to the current role and function of the secretariat might have to be considered. Depending on the assessment mode and authorship model selected (see above), the administrative capacity and scientific expertise of the secretariat could be strengthened, or the GEO process could be simplified, so that the UNEP secretariat can provide the necessary support within existing resource constraints. Alternatively, the UNEP secretariat could support the production of GEO with a much more restricted set of external participants (e.g. an expert panel).

5.4 Coordination among assessments

MEAs produce a significant number of assessments (see Section 3) and, in addition, there are major assessment processes that feed into MEA processes, such as the IPCC and IPBES. Although some of the assessments draw connections to other assessment processes, not all of them do. UNEP/EA.4/L.27, para (10) requests the Executive Director of UNEP to continue to

promote greater coherence and coordination of global assessments undertaken within the United Nations system.

> ***Interview Comment:***
>
> *Everybody wants to coordinate and no one wants to be coordinated. The solution is about seeing the value-added of working together and not competing, but collaborating. GEO should capitalize on all of these other outlooks. They're absolutely critical.*

Annex 1-2 of GEO-6 lists 11 global assessments that were used as key resources for GEO-6. The assessment also considers the interlinkages across environmental challenges and geopolitical, economic, industrial, social, technological and cultural issues. GEO-6 also assesses progress on the Internationally Agreed Environmental Goals (IEAG) that have been established by MEAs, highlighting gaps between the commitments and achievements of these agreements. While GEO-6 takes a "holistic and integrated approach" to assessment and uses results of other assessment processes, it can be argued that it does not produce a systems analysis across the existing landscape of global environmental assessments/outlooks. As Fürst et al. (2017) point out, a systems analysis or nexus approach requires systemic thinking and understanding of the complex linkages and feedback mechanisms in social–ecological systems for delivering integrated solutions, thus addressing key challenges in sustainable development (Liu et al. 2015). An example of such an approach is an ongoing international scientific effort to ensure an equitable access to food, energy and water (Future Earth Knowledge and Action Network 'Food-Energy-Water' Nexus, www.futureearth.org/future-earth-water-energy-food-nexus) by connecting knowledge and bundling case studies to derive recommendations for sustainable resource management.

As Maas et al. (2020) point out, coordination between assessments would support identification of key interrelations between issues. To date, formal coordination has proven difficult to achieve. Reasons for this include differing mandates, a lack of budget for shared work as well as competition between assessment bodies. Informal coordination at the working level may thus be more feasible. Maas et al. (2020) suggest that UNEP's 'Global Assessment Dialogue', which is meant to provide an ad-hoc formalized collaboration between five assessments (GEO, IPBES, IPCC, IRP and GSDR), could be a promising middle ground approach.

Thus, the question for the future of GEO is whether leveraging the work of other assessments should focus on compiling information from other assessments or should go much further in a systemic analysis of environmental challenges.

5.5 Conceptual framework

GEO is a process for an *integrated* assessment of the state and direction of the environment (IEA). In order to carry out this integration, a conceptual framework is needed. To date and in common with most global environmental assessments, the Drivers – Pressures – States – Impacts - Responses (DPSIR) framework has been used by GEO. Figure 7 shows the DPSIR framework used in GEO-6. A number of GEAs such as IPCC, IPBES, and OECD EO connect the elements of the DPSIR framework through dynamic relationships to demonstrate the complex linkages between drivers, pressures and responses. However, there is also a considerable body of

scientific literature that criticizes the DPSIR framework. Gari et al. (2015) reviewed the use of the DPSIR framework for several Social-Ecological Systems (SES), with an emphasis on the coastal environment. This review points to critiques of the DPSIR, such as:

- EEA (1999) emphasized the importance of the dynamics of the links between D, P, S, I and R and warned that the real world is far more complex than can be expressed by simple causal relations.
- Rekolainen et al. (2003) conclude that the framework (i) creates a set of static indicators not considering the dynamics of the system; (ii) fails to capture trends; (iii) does not show clear cause-effect relations for environmental problems; and (iv) suggests linear unidirectional causal chains in the context of complex environmental problems.
- Carr et al. (2007) conclude that the use of DPSIR in sustainable development will likely perpetuate the least satisfactory outcomes of development through ignoring indigenous knowledge about the drivers, the pressures and responses by the local communities and individuals.
- Svarstad et al. (2008) criticize the framework for its shortcomings in establishing good communication between researchers, stakeholders and policy makers and the inability of DPSIR to produce neutral knowledge.
- Kelble et al. (2013) point out that the impact category of DPSIR refers only to negative anthropogenic effects and the response focuses on these adverse environmental impacts, so the framework cannot facilitate a proactive management to sustain or maximize ecosystem services.

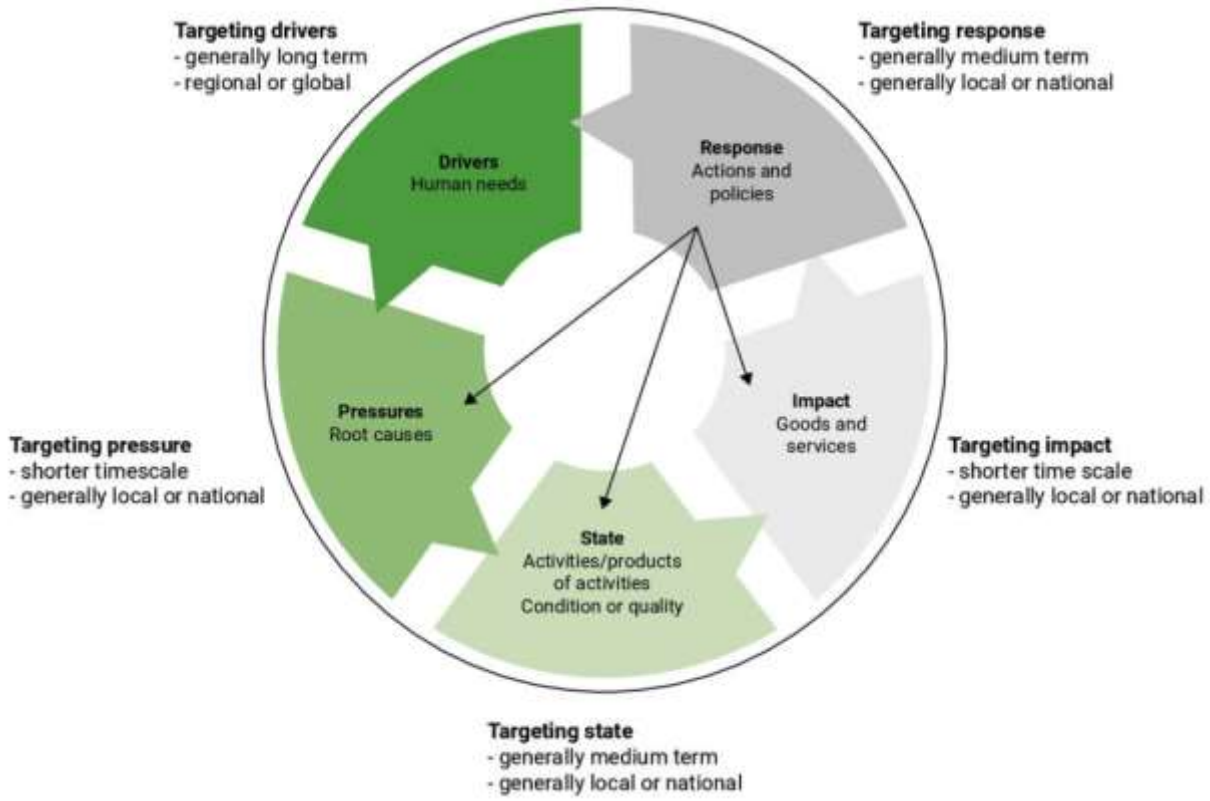

Figure 7: The DPSIR framework used in GEO-6

Given these and other criticisms, the question is whether GEO should continue to use the DPSIR conceptual framework. The answer to this question depends in part on the selected goal and scope of the assessment. If the goal is only to analyse current environmental trends, the framework could suffice, although other frameworks, such as the planetary boundaries framework (https://www.stockholmresilience.org/research/planetary-boundaries.html) could also be considered. If the goal is much broader and the assessment is solutions-oriented and strongly linked to the sustainable development agenda, then frameworks such as integrated sustainability assessment (Weaver and Rotmans 2006) or transition management (Loorbach et al. 2017) could be more useful. As the most comprehensive global IEA, GEO would be well placed to adopt or develop a dynamic model that explicitly represent the components and interlinkages of the Earth System. Many such models have been developed and would be applicable (e.g., Costanza et al. 2007). If DPSIR is retained as the basic framework for GEO, it might be necessary to supplement it with other frameworks in order to address the increasing complexities of social-environmental interactions.

5.6 Scope and scoping approach

As Farrell et al. (2006) demonstrated, one of the most fundamental design choices is how an assessment is framed. Framing choices determine, to a large extent, which features of an issue will receive more attention and which less. One of the key questions in framing, according to Farrell et al. (2006), is how narrow or broad the focus of an assessment should be. They find that while integration is increasingly a goal of assessments, there are certain contexts in which narrowly focussed assessments are more likely to gain salience, credibility and legitimacy.

Over time, the scoping process and the scope of GEO has changed and broadened. GEO-3 provided global and regional perspectives on the past, present and future environment, linked together with examples from within the regions. GEO-3 covered a range of issues: land, forests, biodiversity, freshwater, coastal and marine areas, atmosphere, urban areas and disasters. GEO-4 placed sustainable development at the core of the assessment. GEO-5 continued to look at sustainable development with a focus on "the future we want". GEO-6 focused on a "healthy planet with healthy people".

For GEO-6, a Global Intergovernmental and Multi-stakeholder Consultation defined and adopted the scope, objectives and process for GEO-6 in October 2014. Participants at the Intergovernmental and Multi-Stakeholder Consultation concluded that GEO-6 would be an integrated environmental assessment using the Drivers – Pressures – State – Impacts – Response (DPSIR) approach. The report would build on regional assessments and include an inter-governmentally negotiated Summary for Policymakers. The analysis would aim to present findings and deliver products to targeted audiences including decision makers, across the public and private sectors, such as businesses and the youth. Two planning meetings convened with the High-level Group and the Scientific Advisory Panel in May and June 2016 produced a final annotated outline for the global assessment. Compared with previous GEOs the scope of GEO 6 was extended to evaluate the effectiveness of policies beyond case studies.

> ***Interview Comment:***
>
> *You may want to rethink the opening chapters as opposed to sticking with the silos that never get broken down and the extent to which they do get broken down and the integrated story emerges.*
>
> ***Interview Comment:***
>
> *UNEA and the Governing Council were defining the questions that GEO should answer. Perhaps this process needs to change a bit, where there is a consultative process on what the international community and not just ministers of environment would like GEO to cover.*

The key question with regard to scoping is whether the assessment should have a narrow or broad focus. A scoping phase, based on deliberation and establishment of common positions or perspectives, with participation of experts, governmental representatives and a wide range of other stakeholders, is one key element of an effective assessment process. While the scope of GEO has been quite broad, the scope could be increased by considering perspectives that are not covered by other GEAs, as done in the past, for example, with GEO for youth and for cities.

5.7 Assessment methods

An assessment, in contrast to basic research, brings together knowledge in a way that is useful for decision-making. This knowledge can be in the form of data and model results, but also in narrative form, so a wide range of methods can be applied in assessments. The use of several methods and tools is discussed in Section 3, including the use of integrated assessment models, scenarios and risk assessment.

> ***Interview Comment:***
>
> *What matters a lot is a well-defined methodology. Once you have it, you don't waste time on constantly defending the method. If the method is widely agreed upon, you focus on other things. And this is something I observed in the State of Food Insecurity assessments, you focus on the political message and not whether the assessment was done well.*
>
> ***Interview Comment:***
>
> *[S]ystematic search and review techniques … are now available. And maybe this is something very specific that future GEO assessments could use.*

In the GEO-6 process, an Assessment Methodologies, Data and Information Working Group provided support to the assessment process and provide guidance on the use of core datasets and indicators. They consulted with experts to review the methods used in GEO-6, identify priority environmental indicators as well as data gaps and related issues. The knowledge and data gaps are discussed in Chapter 25 of GEO-6 and provide guidance for future work.

Recently there has been an increased interest in including indigenous and local knowledge in assessments. For example, in 2017, member states of IPBES adopted an Indigenous and Local Knowledge (ILK) approach including: procedures for assessments of nature and nature's linkages with people; a participatory mechanism; and institutional arrangements for including indigenous peoples and local communities. This ILK approach contributes to IPBES assessments through: respecting rights; supporting care and mutuality; strengthening communities and their knowledge systems; and supporting knowledge exchange. Inclusion of diverse conceptualizations of sustainability in assessments is enabled through this approach.

A different methodological approach to assessment is taken by integrated sustainability assessments (Weaver and Rotmans 2006). In a strongly participatory process, the methods include visioning ("the future we want") and experimentation (testing possible pathways to achieve a vision). This approach is based on the assumption that scientific experts are not the only holders of knowledge. If the aim of the assessment is to be transformative, then a number of methodological innovations are required (see Tabara et al. 2018), including the use of agent-based modelling, consideration of non-linear and complex dynamics, assessment of equity and distributional issues and multi-criteria analysis considering efficiency, sufficiency and sustainability of solutions.

One basic question for the future of GEO is whether and how it can develop its assessment methods to fit the needs of various target audiences, eventually towards inclusion of non-governmental actors in a transdisciplinary assessment process.

5.8 Overall structure of GEO reports

The structure of the global GEO has changed since the first report was published. GEO-1 described the environmental status and trends in seven regions. It summarized developments over time in regional policy responses, and concluded with an exploration, based on model analysis, of what could be expected in the future for a selected number of environmental issues, if no major policy reforms are initiated. GEO 2000 also reported on state and trends, outlook and recommendations.

The table in Annex 2 shows the structure of the main report for GEO-3 through to GEO-6.

Each edition covers state and trends, but there is a huge variation regarding other elements. For example, GEO-3 and 4 have a chapter on human vulnerability to environmental change. GEO-5 includes a chapter on the Earth system perspective and covers regional policy options. GEO-6 looks at systemic policy approaches and in detail at policy effectiveness. Interlinkages have been covered since GEO-4.

All of the other Global Environmental Assessments reviewed for this paper include the basic elements covered by GEO: state and trends, policy analyses and scenarios. One consideration for the future is, therefore, whether there is a need for GEO to cover state and trends in great detail, if it is covered by other assessments. Further specifications on the overall structure depend on the initial scoping of the assessment, on the expressed needs of the Member States, on available expertise, on the capacity of the Secretariat to support the process, on the available resources and also on the timeline for the assessment. A key question is to what extent the scope of future GEOs should continue to assess: past, current and projected environmental changes and their drivers; progress towards agreed environmental targets; current and projected risks to human well-being from environmental change; impact of environmental change on the implementation of the SDGs; interlinkages across scales and geographic regions; policy gaps for meeting agreed international goals; effectiveness of policy responses; potentially successful policy approaches; and/or actions needed in the transformation to a sustainable future.

5.9 Quality control

Quality control is an essential element of an assessment process to ensure scientific credibility. In addition to the role of leading figures in the assessment process checking the quality of the assessment, peer review is also a key contributor to quality control.

For GEO-4, about 1,000 experts were invited to participate in two rounds of expert and government review and one round of regional consultations. More than 13,000 comments were received, and were key inputs to the revision of the different drafts. Two Chapter Review Editors (CREs) per chapter assessed whether the comments received were adequately addressed by authors in revising the draft.

The GEO-5 assessment underwent three rounds of review involving more than 300 experts. The first was an internal one within UNEP; the second was an external review by governments and UNEP's extensive network of science and policy experts, including those nominated by governments and other stakeholders. The final review was undertaken by governments and well-known scientific experts from both the natural and social science communities. The final round of expert review was an independent peer-review process facilitated by the Earth System Science Partnership (ESSP). The ESSP sent a call for reviewers to its global expert network and then selected interested experts based on their field as well as gender and geographical balance. In the final expert peer review, each chapter had three to four expert scientific reviewers with extensive experience in the subject area covered by the respective chapter. The content development process and all review stages were supported by the Science and Policy Advisory Board who provided guidance to chapter authors, reviewers and the UNEP Secretariat to ensure that the process was scientifically credible and robust.

The GEO-6 assessment underwent five rounds of review involving more than 1000 experts producing more than 14,000 comments in total. The first nine introductory chapters of the assessment were reviewed earlier in the process than the policy and outlooks chapters. At the end of the review process, all chapters were provided for review by technical experts then for a longer intergovernmental and expert review. For the final review the chapters were provided as individual chapters (25 chapters separately) and as a complete assessment report (all chapters as a single document). This offered reviewers an opportunity to either review specific chapters that were directly related to their areas of expertise or review the whole assessment report to comment on the report's coherence. A pool of review editors was brought in towards the end of the GEO-6 process to assess how completely and credibly the peer review comments were dealt with. This helped mitigate bias and increase the scientific credibility of the process. Finally, the Scientific Advisory Panel was asked to send a letter to UNEP's Chief Scientist with their opinion on the scientific credibility of the GEO process. Due to this process, the draft chapters were re-written, adjusted and edited to improve the quality. The Science Advisory Panel of GEO-6 provided advice on the scientific credibility of the assessment process.

As Maas et al. (2020) have pointed out, recent assessments (including but not limited to GEO) receive thousands of review comments. The assessment procedures usually prescribe that a response is provided for all review comments. This means that the time and effort required for the assessment according to current procedures has increased drastically, while supporting staff has not grown in parallel (Jabbour and Flachsland, 2017).

The review process documented for GEO-4, GEO-5 and GEO-6 has increased. GEO-4 was subjected to two rounds of extensive expert and government reviews and one round of regional consultation and GEO-6 was subjected to 5 rounds of review. Considerable research would be needed to see whether the increased effort has substantially increased the scientific credibility of the assessment. Further consideration needs to be given to the effectiveness of multiple reviews versus one consolidated review phase. The selection of reviewers has also changed over time. The design of a review process for future GEOs will depend on the goal and content of the assessment and the mode of assessment that is adopted (see first section of this chapter).

5.10 Summary for policymakers

A range of assessments produce documents formally titled "Summary/Key Messages for Policy Makers", including the IPCC, IPBES, IRP and UNEP's Global Chemicals Outlook. The summaries prepared by the IPCC and the IPBES are approved by their or plenary. As defined by the IPBES procedures, approval of a summary for policymakers signifies that it is consistent with the factual material contained in the full scientific, technical and socioeconomic assessment accepted by the Plenary. Since GEO-5, the SPM was drafted by the scientific authors and the High-Level Group of representatives of Member States and then the final text was considered line by line and endorsed in a process, similar to that of IPCC and IPBES, in an intergovernmental meeting. This stage of the assessment process is meant to ensure that findings are relevant and understandable to policymakers. The line by line consideration is based on the draft of the scientific findings and can be substantiated by the referenced literature.

> ***Interview Comment:***
>
> *The fact that you have a dialogue between government representatives and experts is in itself a very important dialogue that contributes to a better understanding of the state of science among the policy makers and a better understanding of the burning policy questions among the science community.*

The SPM typically mixes findings and possible conclusions – an option would be to separate the summary of the scientific findings (and keep it in the responsibility of the scientific authors) and a set of policy conclusions (being subject of an intergovernmental process).

The primary audiences for the summary are the formal bodies for which the assessments received their mandate.

> ***Interview Comment:***
>
> *The million-dollar question of GEO-5 was how many MEAs we are going to meet. And the answer was unsatisfactory - we are on track to meet three of them. We walked around with a pie chart on a powerpoint to say that we were failing in every aspect. This is similar to the IPCC that said that we have an x amount of time if we want to hit 1.5 degrees. This is what the press picked up on. The key messages are more important than the products and the summaries.*

In the GEO-6 process, the SPM and a separate set of Key Messages was co-produced by authors and governments. GEO-6 is the first GEO to also produce a Technical Summary (120 pages).

The co-production of a summary for policy makers through an intergovernmental process has, however, been contested (Maas et al. 2020). Some experts reject this practice arguing that 'the science is not negotiable' (e.g., Hulme et al. 2010; Victor et al. 2014), while others support this process arguing it increases government buy-in with the assessments' results (Riousset et al. 2017).

Interview Comment:

> *Governments need to hear what they don't want to hear. We have to find that happy medium between strong support and engagement from the governments and also openness that would allow UNEP to coordinate the global process that brings out the good, the bad and the ugly with the best available science, bring in expert views as well as government policy reflections.*

For the future of GEO, the decision to include a co-produced summary for policy makers depends on scope and goals of the assessment. Consideration should also be given to the co-production of targeted summaries for other groups, such as business, civil society (including Indigenous Peoples and other vulnerable / marginalized groups).

6 Outputs of the assessment

Key messages

- The extent to which GEO's product- and service-orientation should be continued is a key decision for the future of GEO.
- Given that UNEA meets every two years, it could be better informed in a timely fashion with shorter, targeted, frequent assessments.
- GEO could consider providing analysis of the environmental dimension of the SDGs in the periodic Global Sustainable Development Report (GSDR).
- Maintaining an online, continuously updated, interoperable database in some format is a must for the future of GEO but also represents an opportunity for a product and service that has value on its own.
- GEO could provide an essential service in providing capacity building, in particular on the interactions between environmental issues, the systemic nature of human-environment interactions, methods and tools for transition management and the interpretation of global environmental assessments for national policy-makers.

6.1 Service vs. product orientation

While it is most common to think of the outputs of an assessment in terms of reports that are products of the process, attention, in particular in the area of adaptation to climatic change, has turned to the service that the expert community can provide to support the policy implementation by diverse actors in their particular contexts. While there is a fine line between them, service orientation implies more direct attention and rapid, on-demand response to requests for assessment information. For example, at the Third World Climate Conference, 155 nations endorsed the Global Framework for Climate Services (GFCS), whose intent is "to strengthen the production, availability, delivery and application of science-based climate prediction and services." The Global Framework aims to bridge the gap between the climate information being developed by scientists and service providers and the practical needs of end-users (https://public.wmo.int/en/bulletin/what-do-we-mean-climate-services).

Climate services take national and international databases, which provide high quality data on temperature, rainfall, wind, soil moisture and ocean conditions, as well as maps, risk and vulnerability analyses, assessments, and long-term projections and scenarios. They also use non-meteorological data such as production, health trends, human settlement in high-risk areas, road and infrastructure maps for the delivery of goods. The data and information collected are transformed into customized products such as projections, trends, economic analysis and services for different user communities. Thus, climate services equip decision makers in climate-sensitive sectors with better information to help society adapt to climate variability and change.

The main distinction between providing a product, such as a big report, and providing a service, is in the process. As outlined by the WMO (see reference above), it requires multi-disciplinary and cross-sector collaboration, and an agreed framework within which such collaboration can

take place. Based on good practice evidence from climate service pilot projects implemented recent years by WMO and its partners in implementing the GFCS at regional and national levels, five facets have been identified to achieve this:

1. Understand the demand side - end-user participation in the assessment is a prerequisite for success;
2. Bridging the gap between the technical experts (e.g. between climate forecasters and technical experts on agriculture, disaster management, public health etc.) – this requires face-to-face dialogue that has to be mediated and pro-actively inserted into efforts to develop services for end-users;
3. Co-production of services to address end-user needs – with multidisciplinary teams and a range of products to meet the needs of end-users;
4. Communicate to reach 'the last mile' - the format should be suited to local needs and delivered through partnerships with other intermediaries;
5. Assess and reassess – it is necessary to keep assessing whether services still respond to local needs. Participatory Action Research tools have proven instrumental in this respect.

A strengthened service-orientation for GEO would thus imply even more attention to specific user needs, a different assessment framework and enhanced use of participatory methods and diverse communication channels. While the transdisciplinary nature of providing services is challenging, it provides the opportunity to enable improved decision-making and implementation. It could respond to needs for national-level information and advice. Whether a product-orientation or a service-orientation is to be adopted is a key decision for the future of GEO.

6.2 Main products to fulfill the assessment's mandate

Initially, the GEO global report was designed as a stand-alone report and process for the global policy-making and implementation-related audiences. In response to the first global GEO, a number of developing regions requested that the GEO approach be applied also at the regional level. This led to a series of GEOs at the regional and sub-regional level. For example, there have now been four regional assessments for Latin America and the Caribbean. In addition, GEO has produced thematic reports (e.g. the Global Gender and Environment Outlook) and specialized reports (e.g. GEO-5 for Local Government). In the wake of the IEA capacity building program, many GEO's have been also developed at the national level. Within the GEO-6 process, the targeted publications (GEO for Youth, GEO for Cities and GEO for Business) were written by author teams that included representatives of the target group. This co-creation model is meant to increase legitimacy with the intended audience.

The current best estimate of this roll-out of the GEO brand stands at over 300 hundred reports. The length and content of the reports have increased over the years. GEO-6 first produced six regional assessments that were published in 2016, then the main global assessment was published in 2019 together with a separate summary for policy makers. Furthermore, a Technical Summary and 3 main outreach products, GEO for Youth, Business and Cities, have been published.

Recently, global level reports have been accompanied by derived documents targeted towards policy-makers: GEO-5 produced “Keeping track of our changing environment” and “Measuring Progress: Environmental Goals & Gaps”; GEO-6 produced “Measuring Progress: Towards Achieving the Environmental Dimension of the SDGs”.

6.3 Frequency

The global GEO reports were published in 1997, 2000, 2002, 2007, 2012 and 2019. While the first three global assessments had a frequency of 2-3 years, the last three had a frequency of 5-7 years. This change in frequency reflects the increasing number and complexity of the issues covered and the time needed for increased quality control, as well as the mandate provided.

The timing of other key global environmental assessments is summarized in Table 1. Most of the other assessment processes connected with the MEAs are on a 4-year cycle. The next reports are due between this year (Global Biodiversity Outlook) and 2023 (Second Global Sustainable Development Report). If GEO were to remain on a 6-year cycle, it could use information from other assessment processes, which would, however, be somewhat out of date for some issues (e.g. ozone and climate).

Table 1: Timing of global environmental assessments.

ASSESSMENT	**LAST REPORT**	**NEXT REPORT**
Ozone assessments	2018/19	2022 (every four years)
Global Land Outlook	2017	2021
Global Biodiversity Outlook	2020	?
IPBES (Global Assessment)	2019	?
Global Wetland Outlook	2018	?
World Ocean Assessment	2016	2020
Global Sustainable Development Report	2019	2023
IPCC	2014	2021/22
GEO	2019	?
Global Chemicals Outlook I, II	2019	?
Global Resources Outlook	2019	Every 4 years

GEO's timeline is determined by requests from UNEA, so a fixed timeline would need to be decided by UNEA-5. An argument for a fixed timeline is for GEO to provide analysis of the environmental dimension of the SDGs into the regular Global Sustainable Development Report (GSDR), which is currently on a four-year timeline with the next report due in 2023.

> ***Interview comment:***
>
> *The Chemicals Outlook, the Waste Management Outlook and IRP- if they came out a year before, they could have been integrated into this integrative document -GEO. Timing of GEO is really critical. It should come out after all the individual reports come out.*

Evaluations of the outreach of GEO (see next Section) have questioned the value of large global assessments published every 5-7 years. There are calls for more frequent, shorter, targeted assessments. It is argued that since UNEA meets every two years, it would be better informed in a timely fashion with shorter, frequent assessments. This could also be a way to enhance the GEO/Science-Policy-Interface and enhance its effectiveness.

6.4 Digital products and services

As discussed in Section 3, GEO is not involved in primary data collection, but it is a user of all types of environmental and environment-related data collected by others, whether statistical, geospatial or qualitative. Maintaining an online, continuously updated, interoperable database in some format is a must for the future of GEO but also represents an opportunity for a product and service that has value on its own.

A possible service would be a “Digital GEO” with a focus on using modern digital technologies wherever useful. For this service, parts of GEO would be only available in a digital form and supported by artificial intelligence (Digital output). A Digital GEO would be able to address several multiple purposes of GEO and increasingly broader target audiences by supplying both general and detailed information. Artificial intelligence could lead to new or support the finding of new data patterns/correlations. Emerging issues from data analysis would be addressed in in-depth-reviews/special reports. A Digital GEO would emphasize the provision of timely information on emerging issues as well as long-term trends and cross-references to other global/regional/national assessments and support dynamic policy responses (support policy planning). The output of a Digital GEO would thus be continuous service with a supplementary biannual review of selected global indicators to inform the UNEA at regular intervals. This service would, however, also have to deal with the challenges of access to reliable internet and large data /document handling for some countries and users.

Interview Comment:

When we worked on GEO-6 we did not build upon datasets and data that were available from previous GEOs. There is no building and improving and keeping and moving forward and that database isn't being kept and growing.

Interview Comment:

There is value in maintaining true to a certain amount of consistency in GEO so that you can look at trends over time and can track progress … GC 27 asked to keep the global environment under review with nearly real time data. Governments were saying that it is taking too long, we can't wait 5,6,7 years for the next report to come out. We need a product and a process that take the best available information at the time and update the key indicators. Pick a few indicators and put them on a dashboard.

Interview Comment:

I've often wondered whether GEO could make better use of data visualization, and pretty interactive infographics and things like that that really draw people in and spark their curiosity and their desire to explore more than reading a paper book.

6.5 Capacity building products and services

As Farrell et al. (2006) discussed, "assessment capacity refers to the ability of relevant groups, organizations, or political jurisdictions to meaningfully engage and participate in an assessment (i.e. to get past nominal participation) and to sustain this ability over time" (Farrell et al. 2006, p.16). This comprises possessing the necessary linguistic, scientific and technical skills, financial resources and equipment and organizational support. Differences in wealth are an obvious cause of differences in assessment capacity but the overriding goal of sustainable development also points to the need for transdisciplinary skills and scientific skills in integration and systems analysis.

Decision 18/27 A of 25 May 1995 (UNEP 1995) explicitly mentioned that GEO has a role in "promot(ing) the development of data and information management capacity in those bodies situated in developing countries as necessary and appropriate to ensure their full participation". IEAs are complex processes that require specialist knowledge and experience. They also require access to other aspects of capacity such as information, tools and resources. However, as a global assessment that took regional participation and legitimacy seriously, GEO had to involve partners whose IEA capacity was limited. Capacity gaps were known and expected and tackling them was framed as an integral function of the assessment: the practice of 'learning by doing' coupled with targeted capacity building was seen as a way to strengthen IEA capacity where it was lacking. Thus, one function of GEO is to strengthen the capacity in order to improve the quality of contributions to the global GEO.

Addressing the needs for capacity building through involvement in the global process or more targeted action using face-to-face or online materials and programs and through internships is a relevant consideration for future GEOs and also accepted practice in other assessments. In a broader context, IEA-related knowledge and skills can also be integrated into the curricula of relevant university programs. There is evidence this has already been happening, but could be further enhanced through partnerships between UNEP and universities collaborating in the GEO process.

> ***Interview Comment:***
>
> *I think collaborating centers should be engaged, they should be the platforms where capacity is being built, where you actually create that middle layer in a sense of supporters and where you really engage with people.*
>
> *The mapping of MEAs shows that capacity-building and training are provided for by most agreements. Some of the capacity-building frameworks are very detailed and implemented through regional hubs. UNEP provides information on capacity building on environmental issues and also for implementation of MEAs and GEO also has a long history in providing capacity building as shown in Box 2.*

Box 2: Examples of UNEP and GEO Documents on capacity building

- Capacity building for sustainable development: an overview of UNEP environmental capacity development initiatives (UNEP 2002)
- Capacity building related to multilateral environment agreements in Africa, Caribbean, and Pacific countries – the ACP MEAs programme (UNEP 2019b)
- GEO Resource Book: A training manual on integrated environmental assessment and reporting (UNEP and IISD 2007)
- Capacity Building for Integrated Environmental Assessment and Reporting (Pinter, Zahedi and Cressman 2000)
- Methodology for the Participation of GEO Cities Reports. Training Manual, Version 3. (UNEP and Consorcio Parceria 21. 2009)

UNEP's Integrated Environmental Assessment (IEA) on-line interactive training resource platform (https://www.unenvironment.org/integrated-environmental-assessment) collects the IEA tools, methods, case studies and available reports, some of which are listed in Box 2. The platform is essentially a service that also allows users to share their experiences in applying IEA methodologies in their regions, as well as to learn about experience of diverse practitioner networks in other parts of the world. The platform offers the opportunity for communication between colleagues, advertising IEA training events and also participation in the development and testing of new IEA resources. This platform is designed for:

- Governments, practitioners and other stakeholders that are conducting or involved with integrated environmental assessments;

- Students and educators that are learning about environmental assessment.

Given the large range of capacity-building initiatives in the MEAs, it seems that an important need is for capacity building on the interactions between environmental issues and the systemic nature of human-environment interactions. Capacity building on methods and tools for transition management is also needed, given the growing recognition that the SDGs cannot be met by "business-as-usual". With regard to capacity building, Urho et al. (2019) find that national policy-makers often lack capacity to interpret global environmental assessments. This could be a potential role for GEO.

It is also important to recognize limitations that are beyond the direct reach of IEA capacity building programs. For example, turnover of professional staff is a well-known contributor of capacity gaps that may arise even in cases where adequate IEA capacity was known to exist before. As capacity gaps resulting from turnover will continue to be a fact of life, future GEOs will need capacity building strategies that build a broad base of expertise, focusing on the capacity of institutions, not just individual experts.

7 Uptake, use and learning

Key messages

- Before discussing GEO uptake and use, it is important to clarify to whom this endeavour has been directed in the first place. Decision-makers at the international level are the primary audience of GEO as reflected in the mandate given to UNEP in 1972. Secondary audiences include MEAs, the wider UN system of institutions, scientific and professional communities and UNEP itself. Tertiary audiences are related to emerging audiences and the roll-out of the GEO family of reports on multiple geographical scales and for a number of stakeholders.
- GEO has been successful in shaping the international environment and development decision-making processes. GEO has been useful for governments as a reference book as well as a source for contextualizing national initiatives. The uptake among its secondary audiences remains somewhat weak among the MEAs, UN system, UNEP itself and the scientific communities, while uptake among the professional communities has been notable. Over the years tertiary audiences have produced a few hundreds of GEO-related reports localizing the ownership of GEO down into the regions.
- Irrespective of decisions taken on the purpose, governance and outputs of GEO, there are a number of universal recommendations to improve outreach and evaluation practices based on past experiences, current best practices from other assessment processes and contemporary tendencies.

7.1 Evidence of GEO uptake and use

Perceptions over who is and who should be the main audience of the global GEO report and how this audience should be targeted vary greatly among its many stakeholders. In the early days the global GEO was destined to speak to a rather narrow circle of international level decision-makers. Over time GEO has appealed to many audiences and the GEO family of products grew tremendously. The expectations for the global GEO report to speak with specificity and clarity to multiple audiences grew substantially even in the context of numerous spin-offs and companion products. Apart from being a report on "everything environment", it has also become a report for "everyone in environment". Re-calibrating GEO requires a careful examination of its intended and unintended audiences and evidence of uptake among them.

With respect to use and uptake, similar to other global environmental assessments can generate impact at multiple levels and in multiple ways. As demonstrated in the case of GEO-5 by Riousset, Flachsland, and Kowarsch (2017), assessments achieve influence by shaping *coordinative discourses* at the multilateral or national level. By providing conceptual foundations and evidence for such coordinative discourses, GEO-5 was shown to contribute to reflecive learning, the diffusion of global information, escalating interest in global or sub-global environmental problems, and provide arguments to policy actors to put forward ideas for alternative courses of action.

GEO's primary audiences were defined in the UN General Assembly resolution on the establishment of UNEP in 1972 (United Nations General Assembly 1972). GEO's main mission is to inform the multi-level community of decision-makers about the global environmental

concerns; above all targeting international level decision-making. The audiences mentioned above are high-level entities, primarily the UNEP Governing Council (which was replaced by the United Nations Environment Assembly with universal membership in 2014), governments, UN Economic and Social Council and the UN General Assembly.

The description of other duties of the UNEP Secretariat and the Governing Council in the UN General Assembly resolution further extends the list of audiences and potential uses. The GEO has a role to play in steering towards global environmental action through multilateral environmental agreements, as a venue for relevant scientific and professional communities; as a guide for cross-institutional collaboration on environmental matters within the UN system and as a guide to steer the work programme of UNEP itself. Second tier GEO audiences could be broadly grouped around executive and implementation-related functions. The secondary audiences include MEAs and their Secretariats, UN system and the Environment Management Group, UNEP itself and relevant scientific and professional communities.

The list of GEO audiences expanded early on after the first iterations out of a great appreciation for this global process and the insights it provided. Many stakeholders asked what the global GEO message was for a specific region, country, city, ecosystem, stakeholder group. The response to this situation has been to request UNEP to repeat the exercise using the GEO approach for a particular geographical scale or a stakeholder group. Therefore, the third tier of GEO audiences could be grouped around the outreach and spin-off efforts. Many (but not all) of these audiences required additional efforts and specialized outputs to be reached, such as press releases, social media outputs, accompanying methodological or technical documents, adaptation of the global GEO contents for a specific audience or adoption of the GEO assessment principles at various geographical scales. Tertiary audiences include regional ministerial forums, regional organizations, regional subsidiaries of international organizations, national governments, municipalities, youth, education communities, development aid communities, civil society, mass media.

The latest expansion of audiences is related to the new institutional arrangements and newly emerging audiences in the last decade. These include the SDG community, the High-level Political Forum on Sustainable Development, social media and business.

7.2 Primary audiences

Past GEO evaluation reports have been conclusive that the global GEO report reaches its primary audiences (Universalia 2000; UNEP 2000; UNEP and IUCN 2009; Rowe, Ng'eny, and Carbon 2014). Proceedings of the Governing Council of the UN Environment Programme (and of the United Nations Environment Assembly) indicate that GEO has been appreciated and highly valued (GC/UNEP 1997; 1999; 2003; 2009; 2013; UNEA 2019). GEO has been influential in the global summits on environment and development - the Millennium Summit, the World Summit on Sustainable Development and the Rio+20 (Rowe, Ng'eny, and Carbon 2014; UNEP and IUCN 2009; Universalia 2000).

In that respect, GEO-5 stands out the most and has received the strongest approval from the international community of decision-makers. From the very beginning, the GEO-5 was requested to target the international environmental goals, Rio+20 summit and international deliberations for the replacement of the Millennium Development Goals (GC/UNEP 2009). GEO-5 was completed in a timely manner and secured strong government buy-in. The outreach efforts targeted the Rio+20 summit, with the GEO-5 launched just a few days before the summit and accompanied by brief and informative companion products. The Rio+20 resolution "The Future We Want" called for (United Nations 2012):

- the strengthening of the role of UNEP "as the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment" (paragraph 88);
- enhancing the existing science-policy interfaces "including the Global Environment Outlook, as one of the processes aimed at bringing together information and assessment to support informed decision-making" (paragraph 88);
- and stressed "the need for the continuation of a regular review of the state of the Earth's changing environment and its impact on human well-being and … the Global Environment Outlook process aimed at bringing together environmental information and assessments and building national and regional capacity to support informed decision-making" (paragraph 90).

As a result, the GEO-5 evaluation report concluded that GEO-5 had been influential and contributed to the outcomes of the Rio+20 summit. More importantly, GEO-5 helped to elevate the status of both GEO and UNEP, as well as the status of the environment in the international deliberations leading towards the Sustainable Development Goals (Rowe, Ng'eny, and Carbon 2014). Subsequently the UN General Assembly decided to establish universal membership of the Governing Council of UNEP (UNEA)) and secured around 20% of funding needed for the global GEO from the regular UN budget (United Nations General Assembly 2012).

The GEO-6 evaluation was made in the middle of the GEO-cycle, and there is currently no evidence regarding the uptake and use of the last GEO report. Therefore, it is not yet clear whether the main messages of the GEO-6 reports (regional and global) have reached their audiences. Although a number of interviews have been conducted for the "Future of GEO" initiative, their primary goal was not to assess the uptake, use and the effectiveness of the GEO-6 or the overall GEO series. However, there are two important outcomes in relation to GEO-6. First, UNEP became a custodian of 26 indicators related to the monitoring of the SDGs (UN Economic and Social Council 2019) and GEO-6 regional reports have been used in drafting the Global Sustainable Development Report (Independent Group of Scientists appointed by the Secretary-General 2019).

The evaluation reports suggest GEO also reaches Ministers and Ministries of Environment. Its uses at the national level policy-making are related to contextualizing national efforts in the regional and global settings, providing an initial framing for a policy issue and problem identification, drawing on policy examples (Rowe, Ng'eny, and Carbon 2014; UNEP 2000; UNEP and IUCN 2009; Universalia 2000). Policy-makers in the developing world have been

consulting GEO more than those in the developed world (Kok 2008; UNEP and IUCN 2009). The developed world relies more on its own data and sources, policy analysis capacities are more developed and regional or national level environmental assessments are more abundant.

7.3 Secondary audiences

Past evaluation reports find little if any evidence that GEO has helped to shape the work programme of UNEP, or the wider UN family of organizations (Rowe, Ng'eny, and Carbon 2014; UNEP and IUCN 2009). Among the mentioned reasons are GEO is unsuitable for use in strategic planning processes and lacks ownership within UNEP and the UN system (UNEP and IUCN 2009). The usefulness of GEO to the MEAs, secretariats and the conferences of parties also remains largely unknown as the evaluation reports did not study the perspectives of this group sufficiently. Riousset et al. (2017) argue that the impact of the global environmental assessments has been subtle to grasp, but certainly important in shaping the international environmental regimes via consensus building, discourse-shaping and science-policy interface.

Although the scientific community has been largely involved in the production of the global GEO report, it is not so keen to acknowledge its value in the scientific domain via scholarly citations especially in comparison with the IPCC report. One of the arguments for this is that scholars choose to cite the original source instead of quoting GEO. On the other hand, participating scientists and institutions report a number of benefits in relation to their involvement in the GEO. These benefits include new collaborations, expansion of scientific networks, increase in skills and capacities especially for participants from developing countries (UNEP 2004; Universalia 2000). In addition, the GEO global report has been used extensively for teaching in higher education.

Lastly, GEO has been influential with regard to its methodology and process principles for the larger professional community. The GEO approach has become a standard practice in many regions for conducting environmental assessments and state of the environment reports. Capacity building activities have helped to foster this community of practice until 2012. For instance, the GEO methodological approach is traceable in the 5th State of the Environment Report of ASEAN (ASEAN Secretariat 2017), the Assessment of Egypt's State of the Environment report of 2017 (Egyptian Ministry of Environment and CEDARE 2018) and the Report on the National State of the Environment of Peru for 2012-2013 (Peru Ministerio del Ambiente 2014). Arguably, the global GEO has set the tone for the science-policy interface at the regional and national level.

7.4 Tertiary audiences

An extensive effort to document the appeal of the GEO approach to many emerging audiences has rendered around 40 reports on regional and sub-regional scales, over 80 national GEO reports and over 60 local or city-level GEO reports globally over the years (Bakkes, Jan et al. 2019). A clear majority of the GEO spin-off reports on regional, national and local scales have been conducted in developing regions. Impacts of these reports have rarely been communicated or documented, with one significant exception being the review of impacts of the GEO-Cities initiatives in the Latin America and the Caribbean (PNUMA 2012). Other GEO outputs over the years included capacity development outputs, technical reports, thematic spin-off assessments

(like the Black Carbon Assessment (UNEP and WMO 2011)), companion products ("Keeping Track of Our Changing Environment") and GEOs for specific target audiences (youth, cities, business). The total number of reports associated with the global GEO report is a few hundred (Bakkes, Jan et al. 2019).

A variety of institutional and financial arrangements have been used to implement the requests to repeat the GEO exercise on different geographical scales and for different stakeholders. Not all of these initiatives have been completed with the involvement of UNEP. However, capacity building activities led by UNEP and GEO Collaborating Centres in the regions have been instrumental in enabling these spin-off initiatives.

The majority of GEO-related spin-off processes and reports were produced in the developing regions of the world, most notably Latin America and the Caribbean, West Asia, Asia and the Pacific and Africa. The situation in Europe and North America was different. These regions already had regional environmental reporting initiatives run by the European Environmental Agency (European Environment Agency 2020), United Nations Economic Commission for Europe (UN Economic and Social Commission for Europe 2020), the Organisation for Economic Co-operation and Development and the Commission for Environmental Cooperation (OECD 2012).

Last, but not least, mass media has been an important stakeholder of GEO since the early days in transmitting the GEO messages to the wider society. The early iterations of GEO have been particularly well captured by the mass media and have been used as an inspiration and a source for a number of documentary programmes (UNEP 2000; Universalia 2000). Latest editions of GEO have been less visible due to a number of reasons, including a more crowded environmental assessment landscape, GEO's compromised outreach budgets and little evidence of GEO's adaptation to the current trends and technologies in the mass and social media landscape.

7.5 Outreach

While some elements of successful outreach remain the same despite sweeping technological changes (such as meaningful involvement and consultation of all interested parties in the early stages of the assessment or translation of the main outputs into all UN languages), other outreach elements need to be adapted to the current realities. These include:

- shorter attention spans,
- rise of internet, digital media, social media and fake news,
- increasingly crowded global environmental assessment landscape generating an information overkill,
- the necessity of constant messaging instead of one launch every 4-5 years,
- diversity of assessment and outreach products versus "one size fits all".

> ***Interview Comment:***
>
> *We want to go further and we want to link social media and other types of platforms to the information contained in the Global Land Outlook. One of the things we got guidance on is that we need to start producing infographics and other types of communication*

devices that are easily accessible in a snapshot. In GLO-1 and some regional reports we were able to produce nice graphics, turn them around, put them on Facebook, Instagram and other social media platforms and redirect people back to the knowledge hub.

7.6 Evolution of GEO outreach

The GEO outreach strategy has been evolving through time. There are two distinct periods which can be divided into a decentralized and devolved GEO outreach strategy and a centralized GEO outreach strategy.

Initially, the GEO global report has been designed as a stand-alone report and process for the global policy-making and implementation-related audiences. In response to the first global GEO report a number of requests arrived from the developing regions inviting the GEO approach to be applied for the regional, national, local levels as well as specific stakeholders, like the country-specific reports for the youth. The current best estimate of this roll-out of the GEO brand stands at over 300 hundred reports, most of them done in the decade of 2000s. The regional GEO Collaborating Centres have been instrumental in many ways in making them happen. These processes have been accompanied by capacity development and network building activities extending the perception of GEO ownership across multiple levels of decision-making.

Interview Comment:

Thematic assessments are connecting better to what sectors are doing, connect to policy-makers and are action-oriented.

The roll-out of these GEO outreach reports has ceased due to a number of reasons somewhere between GEO-4 and GEO-5. UNEP's partnership with the Collaborating Centre network was abandoned together with capacity building programmes. The replication of GEO reports on regional, national and local scales has slowed down. Instead, more accompanying global level reports were commissioned for GEO-5: GEO for Cities, GEO for Business, GEO for Youth. GEO-6 essentially continued the same centralized outreach strategy with the exception that six regional GEO reports preceded the global report.

Interview Comment:

The yearbooks, the emerging issues assessments, the regional assessments, subregional assessments are equally important and should be brought together in a sequential fashion leading up to a global assessment on a periodic basis.

The difference between the two approaches can be illustrated via the example of GEO for urban settlements. In the 2000s, UNEP's regional offices with the help of the Collaborating Centres were involved directly in developing locally specific GEO reports in collaboration with the administrations of various cities around the world, while lately only one global GEO for Cities was published. While the first approach was more labour intensive and limited in audience, but

potentially more prominent in terms of impact on the ground (see PNUMA 2012), the second approach targeted a bigger community, but may have been too general to suit any of the cities and their specific situations.

The UNEP report on strengthening of the science-policy interface (UN Environment 2017) seems to be echoing the wisdom of the decentralized and devolved GEO outreach strategy by emphasizing issues such as building a specialized strategy for each stakeholder group, responding to information demand flexibly and creating customized outputs, building on feedback, developing partnerships in outreach, developing capacity of identified audiences, moving away from dissemination towards meaningful engagement and exchange. A great deal of this wisdom of the GEO outreach strategy has been elaborated in the GEO Resource Book – Modules 3 and 7 (UNEP and IISD 2007).

> ***Interview Comment:***
>
> *We should look for a form that is more to the point, more concise, that can convey the key messages in a clearer way than big assessment reports.*

7.7 Future outreach considerations

Irrespective of how the next GEO is structured in terms of its purpose, process, outputs, some essential good housekeeping rules for outreach are universal and are laid out here for future consideration:

- Strongly embed outreach and communication in the assessment process with better planned activities, resources and outputs and ensuring that there is adequate expertise in outreach and communication within the core assessment team;
- Consult key stakeholders (not only governments) during the initial phase of the assessment in a meaningful way, and consider strengthening the scoping stage of each new GEO (IPBES is a good example of procedures for scoping for new assessments and involvement of non-governmental actors, such as MEAs, indigenous groups, other institutions)
- Meaningfully engage UNEP's regional offices and regional partners to build GEO ownership at regional, national and local level;
- Provide detailed information on "How to conduct a GEO process" and foster communities of practice: provide methodological and process guidance for regional, national, local and thematic spin ;
- React flexibly to the needs of stakeholders and to the recognized meaningful research contributions to roll out specific GEO products (GEO for Youth published in 1999, or the Black Carbon Assessment published in 2011);
- Communicate impact to help self-reflection, evaluation as well as fundraising (IPBES is a source of good practice);
- Transparently document the GEO process cycle as well its financial accounts on the website to facilitate any public inquiry (IPBES does that in an exemplary manner);
- Reflect critically on the specific needs and circumstances in the regions of UNEP and tailor outreach strategy accordingly (for instance what is that GEO can offer to Europe with its own

crowded environmental assessment landscape? How could GEO messages be tailored to the region of Asia and the Pacific – the most diverse region?)

- Strengthen capacity building programmes as "shortfall in capacities limits use" (Rowe, Ng'eny, and Carbon 2014)
- Secure stable finance for continuous outreach work. All GEOs starting from GEO-4 have had their outreach budgets cut in a major way (UNEP and IUCN 2009; Rowe, Ng'eny, and Carbon 2014; UN Environment 2018);
- Improve digital presence. The current digital presence of the GEO report is not optimized for search engines. In other words, GEO is not easily discoverable to the new internet-bound audiences, whoever they may be, without prior knowledge of the initiative;
- Improve social media presence. GEO has sufficient insights and material to be broadcasting them in between the GEO cycles responding to the mass media pulse. GEO is not present on social networks currently and social media dissemination is being run via the general UNEP channel;
- Improvise with formats of outreach (IPBES is starting a podcast series);
- Involve GEO authors in regional, national and local dissemination activities (IPCC has a handbook for assessment authors on effective communication and public engagement (Corner et al 2018)).

Interview Comment:

It was very odd that there were all sorts of other UNEP reports coming out at the same time. In my view we did not get full value from any of them. There was competition between different parts of the same organization. That was a strategic mistake. The executive director should take a strategic overview of when these reports are going to come out and make sure they don't trip over each other.

7.8 Evaluating GEO

GEO evaluation reports are the main sources for evaluating the uptake and use of the GEO. Every GEO iteration has had a follow up in the form of an evaluation report. Some of these evaluations have been carried out by independent providers (in the case of GEO-1, GEO-3 and GEO-4) (Universalia 2000; UNEP 2004; UNEP and IUCN 2009) and others – by the internal Evaluation Unit of the UN Environment (the case of GEO-2, GEO-5 and GEO-6) (UNEP 2000; Rowe, Ng'eny, and Carbon 2014; UNEP 2018).

A significant limiting factor of these evaluations is that they focus on the global GEO report only. Over the years there have been a number of different GEO spin-off reports on different geographical scales (regional GEO reports, national GEO reports, local GEO-Cities reports), thematic focus (e.g. GEO Gender), audience (GEO for Cities, Business and Youth), companion products (e.g., "Keeping track of our changing environment"). As mentioned above, no systematic follow up has been performed on the effectiveness of many of these GEO products that to some degree form an inseparable GEO family of products. This gap exists for many

unaccounted important impact pathways along these different GEO inspired reports and prevents a systematic reflection on the role and purpose of (global) GEO. On a more practical note, some of the spin-off products may benefit from a critical assessment of their effectiveness and a re-calibration of their key design properties. For instance, does the GEO for Youth and GEO for Business really reach its intended audiences? What are the ways for a specialized GEO-style assessment to speak more effectively to these audiences? Is a report format the best vehicle?

A key question is on evidence of uptake and use of GEO reports. Currently, there is no consistent information on which specific policies and initiatives that GEO has influenced or set in motion and in general how GEO has had an impact on the environment and society. A number of internal self-monitoring procedures could be implemented in addition to regular and systematic review of the assessment effectiveness. Establishing an internal database on the uptake and use of the assessment products could be a good practice to be adopted from IPBES. The database should also keep track of scientific citations of GEO reports. Collection of evidence on GEO impact should be a continuous process. This would help in a number of ways: by facilitating the evaluation work, by helping to build institutional memory of the process, by allowing to reflect internally on the GEO cycle and by mobilizing evidence for fundraising for GEO.

Interview Comment:

The other thing that we lack and what could be useful is monitoring. Often, we do these reports and we stop, we have checked the box, but we don't really engage in monitoring after the fact.

Interview Comment:

At the moment GEO just appears once every 6-7 years and then it goes away. There is no follow up, no sense of monitoring. Are we making progress? So that the next time GEO comes along we would actually be able to look back. At the moment there is no way of knowing whether GEO has had any practical impact or not.

UNEP has made little if any effort to communicate GEO's impact widely. Although most of the GEO evaluation reports are publicly accessible on the UNEP website, they are difficult to find and are not reader-friendly. A number of brief statements in the form of infographics on the uptake and use of GEO would help to bridge multiple gaps. Lack of communication efforts on GEO's impact may have led to poor understanding of GEO's purpose, role and impact, and may have led to little appreciation of the GEO among its potential donors (Urho et al. 2019). Many of GEO's authors and contributors have not been aware of the degree of usefulness of their efforts. This affects both motivation and a feedback loop between writers and users.

Interview Comment:

IPBES has a tool on the website that tracks outreach. Social media is used to inform about how IPBES reports are being used by whom. For example, the reports can lead to a new policy, new law, decision at city level, public lecture. People give feedback on the use and this is stored in a database.

8 Assessment finance

Key messages

- In terms of its cost structure GEO is comparable to some of its GEA peers, but its overall annual cost is significantly lower.
- Stable financing across assessment cycles is critical for the adequate functioning of GEAs; while the financing of some GEAs can be considered stable, the funding model of GEO in particular cannot be considered sustainable.
- Funding shortfalls can and did undermine essential assessment functions.
- Given the central role of GEO for UNEP's mandate, funding model options should include the proposal to fund GEO through the regular UN Budget or through a dedicated trust fund.
- COVID-19 may lead to further financial hardship but may also present opportunities for cost cutting e.g., travel cost reduction due to virtual collaboration.
- Transparency and accountability of the financial management is a must under all circumstances.

8.1 Cost structure of GEAs

Undertaking global environmental assessments requires significant resources and the consideration of both the assessment's cost structure and the sources of financing. While the academic literature that deals with the design, effectiveness and many other aspects of assessments in great detail paid almost no attention to finance, most assessment functions clearly could not be fulfilled without adequate resources.

An initial funding estimate put the annual cost of a Global Environment Outlook at USD25M (Bakkes et al. 1998). The estimate assumed that UNEP would not need to charge for data, regular interaction with regional audiences, a significant role for collaborating centers, investment in the institutional framework and capacity of monitoring, contribution to other UNEP assessments and a well-functioning GEO secretariat.

The structure of GEO financing for GEO-4 and GEO-5 (based on figures in the 2010 budget plan) is shown in Figure 8. Note the elimination of funding for MoUs with partners in the GEO collaborating centre network and the significant increase for support systems. The underlying changes were related to a general shift in GEO towards an IPCC-style science assessment and a major investment in digital products and services, most importantly UNEP Live.

Figure 8: The structure of GEO-4 and GEO-5 financing (Source: UNEP/GC.25/3/Add.1; Intellectual History of GEO, forthcoming).

While their details vary, the comparison of GEO's cost structure with the cost structure of key global assessments is instructive. The cost categories in Table 2 have been synthesized from the annual budgets of some of the leading global environmental assessments, and the publication of official cost estimates. Further details are available in an Excel file online[1]. Even if a direct comparison is not always simple due to differences in budget structures and assessment approaches, the table shows that compared to some other key global environmental assessments, indicative comparison is possible and shows that overall GEO-6 was run on a significantly tighter budget.

Table 2: Cost structure of selected existing GEAs (in US $).

Cost category	GEO-6	IPBES	IPCC
Governing bodies	240,000	1,760,900	1,126,000
Expert meetings and workshops (includes: travel	1,045,000	3,327,750	2,111,000
Secretariat	988,000	2,953,160	2,086,000
Partnerships	20,000	0	0
Capacity building	50,000	680,000	0
Infrastructure and services	30,000	0	135,000
TOTAL average annual costs	**2,355,000**	**8,721,810**	**5,458,000**
process duration (years)	3	n.a.	6
Report production [and other one-off costs]	**5,790,000**		0
Total Cost	**12,909,000**		**32,748,000**

8.2 Assessment financing models

As the flagship publication of UNEP, one would assume that the budget of GEO has been reasonably secure and stable over the years. This is not necessarily the case. One of the enduring features of GEO's budget has in fact been its inherent uncertainty and changing sources. Uncertainty is likely to increase due to the COVID-19 related economic meltdown. While the pandemic is putting national budgets under heavy pressure, there may also be opportunities for cost reduction through increasing acceptance of working remotely that would reduce budgets required for travel. How the different effects will balance out is currently unknown. Considering alternative financing models for future GEOs has therefore never been more timely.

Interview Comment:

One has to be realistic, the budget of UNEP is not going to increase. There will be financial hardship in many of the donor countries for the foreseeable future, 2-3 years. The financial resources will force UNEP to slim down the process….To scale down the whole exercise would be my advice, but not jeopardizing the scientific and political credibility of it.

Unlike several other global assessments, GEO does not have a dedicated trust fund. The main sources of GEO's funding were the Environment Fund and earmarked voluntary contributions by member states. For the first time in its history, GEO received a modest contribution from the UN Regular Budget during GEO-6. The importance of voluntary bilateral contributions significantly increased, but also indicates a vulnerability, as donor priorities and the ability or willingness to support GEO vary. In addition to financial contributions, GEO received in-kind contributions either through collaborating centers or individual experts who donated all or part of their time. Some of the associated products of GEO, such as city-level GEOs or some of the national capacity building activities using GEO know-how were funded by third parties.

Interview Comment:

How do we make this process more efficient and not perpetuate the model of the past? We as UNEP must come up with an innovation in getting a robust and authoritative product, but doing it in a way that is much more cost-efficient and time-efficient.

As research for the review of GEO's funding from GEO-1 in the forthcoming *Intellectual History of GEO* volume found, all GEOs where financial data is available have experienced a funding shortfall, at least for part of their process. Among the more recent GEOs, both the GEO-5 evaluation report and the midterm evaluation of GEO-6 found significant funding gaps that emerged during the assessment process and required both the mobilization of external funds and a deep restructuring of activities. Such unforeseen – but perhaps foreseeable - funding shortfalls are highly disruptive for the assessment process and it is hard to see how they would *not* be consequential for assessment quality.

The focus of voluntary contributions shifted over time and included, among others, support for developing methods and specific sections of the main GEO report, support for capacity building and training at the regional or national level, supporting meeting costs associated with the global assessment process or covering the costs of translation. As a result of inherent uncertainty in GEO's funding model, fluctuating external funding, some of the areas of focus that emerged at one or another stage of the process were phased out or significantly curtailed later. For example, as soon as external resources became unavailable, GEO's capacity building activities around GEO-5 came to a rapid halt and the collaborating center network dissolved. Delays in the delivery of committed funds also represented uncertainty and were disruptive (Rowe, Ng'eny, and Carbon 2014).

Interview Comment:

I don't think we should start from the point of view "this is how much money we have, let's see what it gets us". No. We should start from here's what we need to get. How much would that cost? And this is the one thing that has not been done well at UNEP.

A significant funding gap emerged and had to be addressed mid-course in GEO-6 due to a significant drop of member state contributions to the Environment Fund from 2016. This resulted in a budget cut and the disruption of some of the essential activities of the assessment, including travel and meetings (Annandale 2018). While most of the shortfall was eventually addressed through extrabudgetary contributions, the fate of several important communication and outreach activities, including the translation of the GEO-6 report into all official UN languages were put on hold (UNEP 2018).

Interview Comment:

The Global Land Outlook has a separate resource mobilization team within the secretariat. They are provided with substance and go out and lobby different country parties. Basket funding is very important, rather than project funding.

8.3 Financing models of other comparable assessments

Considerations for the financing model of GEO can build on information about the financing of other comparable global assessments. The picture is fragmented, as academic literature on assessment finance is absent and only a few assessment mechanisms make information on their financing publicly available. However, based on the information that *is* available a few general patterns can be identified.

8.3.1 Global Biodiversity Outlook

The CBD is financed through both regular contributions of Convention members to the core budget and voluntary contributions to Trust Funds (CBD 2020). Both the core budget and Special or Voluntary Trust Funds are approved by the Conference of the Parties. The budget of the Global Biodiversity Outlook-5 included core contributions to Secretariat staff, but presented both core and optional activities that could be undertaken if resources were to become available (CBD 2017). Institutionally, the GBO is an integral part of the Strategic Plan for Biodiversity 2011-2020 by reporting on its progress and achievements, including its means of implementation and resource mobilization. The budget put forward by the Convention Secretariat for the most recent GBO-5 included two scenarios, one for the core GBO report only (USD576,000) and another that includes optional activities (USD1,333,000). Both the overview of the process and the budget are transparent, publicly available and detailed enough to support planning. Besides the cost elements directly associated with the production of GBO-5, the planning document mentions that staff funded from core resources have already been allocated to the GBO Secretariat, which reduces the level of uncertainty.

8.3.2 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

IPBES grew out of the work of the Millennium Ecosystem Assessment (MA), which was conducted between 2001 and 2005. Similar in terms of structure and complexity to GEO but a one-off exercise, the MA was funded by a consortium of donors including private foundations, governments, multilateral organizations. It also involved many in-kind contributions by research organizations, universities and others. The total indicative budget of the MA was put at USD24 million, out of which USD7M was in-kind and USD17M was cash (Millennium Ecosystem Assessment 2005).

IPBES is financed through a Trust Fund whose operation is governed by a set of transparent rules and procedures (IPBES No date.) The Trust Fund receives contributions from both public and private sources, but private sources cannot exceed 50% in any given biennium. IPBES invites and receives pledges and has a clear procedure for dealing with them, with a stipulation that pledges do not orient the work of the Platform in any way. The same applies to in-kind contributions. IPBES maintains a working capital reserve to even out any significant and unexpected fluctuations in funding and set at 10% of the total budget for any given biennium. IPBES' rules include provisions for distribution of the assets of the Panel, may its liquidation become necessary.

8.3.3 Intergovernmental Panel on Climate Change

The IPCC is funded through a Trust Fund that was set up in 1989 when the organization was established. Contributors to the Trust Fund include the two founding organizations, UNEP and the WMO, plus the IPCC's member states. Based on a cost sharing agreement WMO covers the cost of housing the IPCC Secretariat and the salary of the IPCC Secretary, while UNEP pays for the salary of the Deputy Secretary. IPCC Member states provide a voluntary cash or in-kind contribution that may be general or intended for specific activities (IPCC 2020). Budget projections are provided for three years and take standardized cost elements associated with Panel and Bureau sessions and travel costs of meeting into account. IPCC's budget details are publicly available and transparently show both the source of revenues and expenditures, the former broken down by country and both for the actual budget year plus cumulative. According to its financial stamen the IPCC's total expenditure for 2018 was CHF5,604,000 (IPCC 2020). The IPCC's finances are overseen by a Financial Task Team, co-chaired by two government representatives from the IPCC Bureau and selected by the Bureau.

8.3.4 International Resource Panel (IRP)

The IRP is composed of a Panel, a Steering Committee and a Secretariat. It is governed through a Steering Committee of multilateral and national organizations that are expected to make a cash or in-kind contribution. Members from OECD countries 'shall', developing country members will 'strive' to provide a contribution. The contributions are thus voluntary and amounts provided by private donors in any given year are not permitted to exceed funding from public sources (IRP 2016). In addition to cash contributions, members may also provide in-kind support in the form of staff time, commissioning special studies, hosting meetings, translation or products etc. The Steering Committee oversees the IRP budget and provides resource

mobilization advice. The secretariat, hosted by UNEP, is responsible for managing cash flow, preparing budget proposals, expenditure monitoring and auditing. It also prepares and submits to the Steering Committee an annual financial report (IRP 2016). The full IRP budget is not published on the IRP website.

8.3.5 The Regular Process and the World Ocean Assessments

The Global Integrated Marine Assessment was published once in 2015 under the authority of the UN General Assembly (Group of Experts of the Regular Process 2016). Regarding the funding for the Regular Process, the need for dedicated resources to be allocated to the implementation of the second cycle (2016-2020) was one of the main lessons learned from the first cycle (2010-2014). Different from the first cycle, resources were secured, including from the regular budget of the United Nations, for the programme of work for the period 2017-2020 for the second cycle of the Regular Process. The budget for the second cycle of the Regular Process included, inter alia, funding for two posts for the secretariat of the Regular Process, for the development and maintenance of a website, travel funds for experts to attend meetings and regional workshops, and funds to edit and translate the outputs of the second cycle into all official languages of the United Nations. In accordance with General Assembly resolution 64/71, the Secretary-General established the Regular Process voluntary trust fund for the purpose of supporting the operations of the first five-year cycle of the Regular Process, including for the provision of assistance to members of the group of experts from developing countries, in particular least developed countries, small island developing States and landlocked developing States. Pursuant to General Assembly resolution 68/70, it was further requested that the Secretary-General administer the voluntary trust fund beyond the first five-year cycle and for the duration of the operations of the Regular Process. Contributions to the trust fund may be made by States, international financial institutions, donor agencies, intergovernmental organizations, non-governmental organizations and natural and juridical persons. Contributions to this voluntary trust fund during the second cycle supported, inter alia, the travel of members of the Group of Experts from developing countries to a number of meetings, including those of the Ad Hoc Working Group of the Whole, the Group of Experts and the writing teams.

8.3.6 Global Sustainable Development Report

The GSDR is facilitated by the Division for Sustainable Development Goals of the United Nations Department of Economic and Social Affairs, which is part of the UN Secretariat. The report was mandated by General Assembly resolution 70/299 (Group of Experts of the Regular Process 2016). UN DESA is funded and supported through in-kind contributions for the regional and thematic consultations and some additional activities by a range of multilateral, governmental as well as non-governmental organizations, although specific funding was provided for the GSDR.

8.3.7 OECD Environment Outlook

The OECD regularly publishes an environmental outlook that covers environmental prospects of its member states (OECD 2012). The latest report included projections for a 2050 time horizon and it was prepared in collaboration with the Dutch Environmental Assessment Agency (PBL). The report is produced under the authority of the OECD's Secretary General, funded from the core budget of the organization, and bilateral cash and in-kind contributions by member states. The OECD's budget is determined by the size of the members' economies and also includes

voluntary financial contributions. While the overall annual OECD budget is well documented and shows EUR18,718,000 for its work on environmental sustainability, it does not show the cost of the OECD Environment Outlook separately (OECD 2019).

8.4 Considerations for the future of GEO

The analysis of alternative financing models takes five perspectives into account: the overall financial model of UNEP as the parent organization of GEO; the financial management of GEO itself; lessons from the financial management approach of other comparable assessments; the likely perspectives of GEO's possible funders; and general good financial management practices.

The financing options available to the future of GEO need to be viewed in the broader context of the *financial architecture of UNEP* as its parent agency. As shown on Figure 9, UNEP's overall financial model represents a vulnerability, particularly in light of the ever-growing range of environment-related concerns and initiatives. UNEP receives a relatively modest contribution from the regular budget of the UN, which is based on assessed contributions of countries. More resources are available through the organization's Environment Fund, however, contributions to the Environment Fund are voluntary and tend to fluctuate. Over the years, the volume of earmarked contributions significantly increased (Figures 9 and 10).

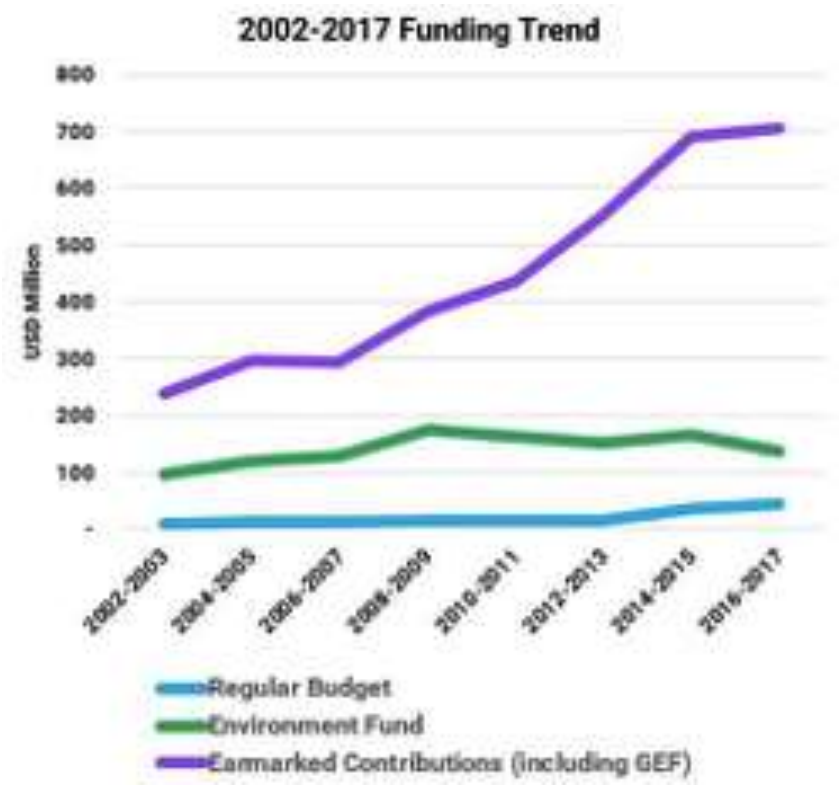

Figure 9: The sources of UNEP's funding (Source: https://www.unenvironment.org/about-un-environment/funding/funding-facts/)

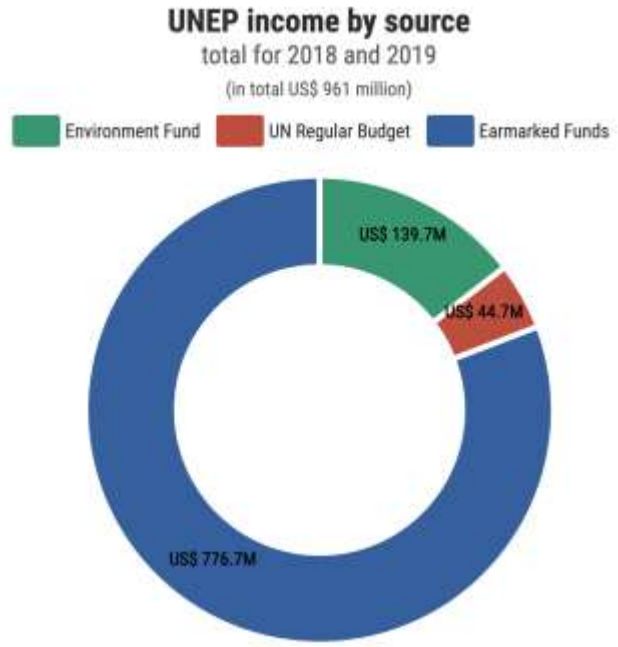

Figure 10: UNEP's income for the 2018 and 2019 biennium (Source: https://www.unenvironment.org/about-un-environment/funding/funding-facts/)

The concerns are not new, and earlier observations made in a review of UNEP's governance structure still largely stand:

"The root cause of UNEP's problems is the organization's unique financial structure. Unlike all other international organizations whose budgets are based on predictable mandatory assessed contributions, UNEP is completely dependent on the voluntary contributions of individual states. UNEP's unreliable and highly discretionary financial arrangement compromise the financial stability of the organization, its ability to plan beyond the current budget cycle, and its autonomy, thus instilling a risk-averse attitude within the organization's leadership. UNEP's de facto agenda is set by individual priorities of donor countries, which has resulted in a fragmentation of UNEP's activities and lack of clear prioritization." (Ivanova 2005)

As long as UNEP's financing model is based largely (ca. 95%) on discretionary funds, the organization would have very limited ability to either core fund GEO or even to address significant temporary funding gaps with bridge financing. These are clearly not issues that GEO itself can address, but the conditions are material for how GEO's finances are run.

Interview Comment:

One of the aims of the UN is to contribute to the global knowledge products and part of the resources should be allocated to that. It is very important to have a part of the regular budget dedicated to the normative work to produce global knowledge products. The point is to redefine those and make sure that we go with fewer knowledge products but of better quality. It is also important to look at our mandate within the UN, I know how difficult it is to define where the borders are between our respective work. This type

of discussion should be taken up on the higher level. There is no point in FAO working on migration, UNEP working on food. There should be a discussion about who has a comparative advantage to do what.

The review of *GEO's financing* shows that the present model is not only vulnerable but on the longer run unsustainable. The issue is not simply the level and predictability of funding, although those are absolutely essential for being able to systematically implement GEO's workplan. Financial transparency and accountability are critical for securing and keeping the trust of GEO's funders. Arising in part from its uncertain funding structure, GEO's financial management appears to be ad hoc and improvised. While the ability to address budget crunches is commendable and shows that at the end of the day donors, or at least some donors, see value in GEO to finance its operations, the lack of predictable financing would undermine the quality, **impacts and effectiveness of any program.**

Interview Comment:

Partnership with collaborating centers. If there is a long-term relationship, part of the funding mobilization could be taken out of the hands of the secretariat and become the responsibility of the collaborating institutions

The review of the financing model of other *comparable assessments* also shows some important differences. Other assessments and outlooks are either core funded through organizational budgets or have dedicated trust funds. While neither of these are of course entirely secure they provide more ability to plan and implement assessments as planned. It is not that voluntary bilateral contributions are not useful, but their proportion and the type of activities they support matters. It is one thing if voluntary contributions finance optional or associated activities or products such as special reports, data collection or capacity building. These in fact represent opportunities for special fundraising drives. It is another if core operations, processes and products depend on them.

Interview Comment:

I think there is a massive opportunity for strategic collaboration. It is possible that future GEO could be a combination of the World Economic Forum, UNEP, WHO, FAO. It could become an interagency thing…I would like to see some of these organizations coming into a partnership to deliver a fully integrated assessment and with that I would like to see their funds and their secretariats.

The *perspectives of donors* also include GEO's main audiences – governments themselves. While they provide the mandate for GEO and expect UNEP to deliver, they also have a key role in enabling the organization to do so. At the same time, even though GEO is a government-mandated process, its funders do not need to be limited to GEO. As shown by some other assessments like the IRP, other non-government actors can play an important role. While some assessments are limiting the scale of contributions from private sources, significantly broadening

the pool of funders is clearly a realistic option, and it may also engage other parts of the audience that may then develop more interest in the assessment's products.

Finally, no matter what option is selected, *sound financial management* is a must. This of course is primarily a task for UNEP and the GEO secretariat, but as the example of some other assessments show, donors also play an important role by convening an oversight body that takes deep interest in the financial system of the assessment. This can contribute to transparency and reduce the risk of major financial crises, as long as there is regular monitoring and forecasting of the financial picture and balance sheet. Publicity of financial details is also essential.

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[1]

https://drive.google.com/file/d/1tmqJt1UbwfODoKYnR_SWHoFalSI_lWF_/view?usp=sharing

9 Conclusions

The purpose of global environmental assessments can be considered in the broadest sense as improving the quality of environmental, sustainability-related decision-making and increasing the likelihood that good decisions can and will be made. The functions of GEO need to be defined in view of the assessment's present and intended place in the global assessment landscape. Specific functions include:

- informing UNEA;
- supporting policy planning, implementation and review at global and sub-global levels;
- advancing and demarcating integrated, systems-based perspectives;
- leveraging other assessments and UNEP work;
- formulating, implementing and assessing progress towards global goals;
- collecting, interpreting, using and storing data; and
- contributing to capacity building.

In the specific case of GEO, it is necessary to decide which of these functions will be covered in the future and in what order of priority.

In order to exercise influence and achieve impact, assessments must constructively engage with target audiences and processes where significant environment-related decisions are being made. While traditionally this meant interaction between scientists, policymakers and – to some degree also other stakeholders, more attention could be given to including a wider range of social groups and interests. **For the future of GEO, it is necessary to consider how to further develop the co-creating of knowledge and open exchange with non-governmental actors.**

The governance and implementation structure of assessments like GEO-6, IPCC and IPBES involves a broad range of structures involving many actors with various roles and responsibilities, but other governance models for major assessments could be considered. **For the future of GEO, it would be important to clarify whether to continue with the current governance and implementation system or to incorporate elements of network governance.**

Partnerships with collaborating institutions can be seen in several global environmental assessments as a mechanism for enhancing capacity and connecting with stakeholders. Both the IPCC and IPBES have substantive Technical Support Units to provide support for the assessment processes and other functions, which in the case of IPBES includes capacity building, policy support, indigenous and local knowledge, scenarios and modelling. Up until GEO-4, UNEP had used a similar, albeit less formally structured, collaborating institution model both as a means of contributing to the analysis and as a way of enhancing capacity for undertaking the assessments and connecting with thematic and regional stakeholders. **For the future of GEO, it is necessary to consider whether supporting and collaborating institutions could play a stronger role to enhance the assessment and other functions.**

Assessments are designed to be perceived as credible, salient and legitimate by participants and users. So far, GEO has been designed as an assessment process with co-design and co-

production features which involve a dialogue between independent experts, member states, stakeholders and partners with a view to identify the policy relevance and confidence levels on the state of scientific knowledge in an assessment report. **The question for the future of GEO is whether to continue with this approach or whether it should seek different strategies and design to achieve enhanced levels and better balance between salience, credibility and legitimacy.**

One of the most fundamental design choices is how an assessment is framed. One of the key questions in framing is how narrow or broad the focus of an assessment should be. While integration is increasingly a goal of assessments, there are certain contexts in which narrowly focussed assessments are more likely to gain salience, credibility and legitimacy. **The key question with regard to the scoping of GEO is whether the assessment should have a narrow or broad focus or a hybrid - a broad-brush assessment and a deeper analysis of a topic or topics that are particularly relevant for given audiences and for a given assessment cycle.**

The large number of authors participating in GEO is connected with a broad coverage of different disciplinary and geographical perspectives. However, it is also associated with high transaction costs. One alternative would be a standing panel of authors. A second alternative could be authors from administrations or commissioned studies. **The selection of authors for future GEOs will depend on a number of factors, including the scoping and timing of the assessment, the availability of resources and whether the assessment aims to be transformative or solution oriented or only to report on the state and directions of the environment.**

In the GEO process so far, the UNEP secretariat has provided technical support for the development process and mediated between authors and member states and their representatives. It also monitors the process to ensure that the assessment remains in line with the mandate provided by the countries. In particular with respect to the availability of resources in the next few years as a result of the COVID-19 pandemic, alternatives to the current role and function of the secretariat might have to be considered. **For future GEOs, depending on the assessment mode and authorship model selected, the administrative capacity and scientific expertise of the secretariat could be strengthened, or the GEO process could be simplified, so that the UNEP secretariat can provide the necessary support within existing resource constraints.**

MEAs produce a significant number of assessments and there are major assessment processes that feed into MEA processes, such as the IPCC and IPBES. Thus, the question for the future of GEO is whether leveraging the work of other assessments should focus on compiling information from other assessments or should go much further in a systemic analysis of environmental challenges.

GEO is a process for an *integrated* assessment of the state and direction of the environment (IEA). In order to carry out this integration, a conceptual framework is needed. To date and in common with most global environmental assessments, the DPSIR framework has been used by GEO. **The question is whether GEO should continue to use the DPSIR conceptual framework. The answer to this question depends in part on the selected goal and scope of the assessment. Frameworks, such as the planetary boundaries framework or integrated sustainability assessment, incorporating elements of transition management could be considered.**

An assessment, in contrast to basic research, brings together knowledge in a way that is useful for decision-making. This knowledge can be in the form of data and model results, but also in narrative form, so a wide range of methods can be applied in assessments. **The basic question for the future of GEO is whether to continue with a primarily interdisciplinary scientific approach or to move to a transdisciplinary inclusion of non-academic knowledge in order to develop transformative solutions and to better reach out to the needs of the various target audiences.**

A range of assessments produce documents formally entitled "Summary/Key Messages for Policy Makers". Since GEO-5, the SPM was drafted by the report authors and the High-Level Group of representatives of Member States and then completed through a line by line consideration and endorsement of the summary in an intergovernmental consultation with the leading authors of the assessment, similar to the IPCC and IPBES process. **For the future of GEO, the inclusion of a co-produced summary for policy makers could be continued to be complemented by co-produced targeted summaries for other groups, such as business and civil society.**

A further development of the service-orientation of GEO would imply increased attention to user needs, a different assessment framework and enhanced use of participatory methods and diverse communication channels. **The extent to which GEO should move in this direction is a key consideration for the future of GEO.**

While the first three global GEOs had a frequency of 2-3 years, the last three had a frequency of 5-7 years. It is argued that since UNEA meets every two years, it would be better informed in a timely fashion with shorter, targeted, frequent assessments. A fixed timeline could be adopted if GEO were to provide analysis of the environmental dimension of the SDGs into the Global Sustainable Development Report (GSDR). **The future of GEO process needs to consider the timing of GEO with regard to the needs of the primary audience and the coordination with other assessment processes.**

Addressing the needs for capacity building through involvement in the global process or more targeted action using face-to-face or online materials and programs and through internships is a relevant consideration for future GEOs and also accepted practice in other assessments. GEO could provide an essential service in providing capacity building, in particular on the interactions between environmental issues, the systemic nature of human-environment interactions, methods and tools for transition management and the interpretation of global environmental assessments for national policy-makers. **The question for the future of GEO relates to the priority given to capacity building.**

Perceptions over who is and who should be the main audience of the global GEO report and how this audience should be targeted vary greatly among its many stakeholders. Decision-makers at the international level are the primary audience of GEO as reflected in the mandate given to the UN Environment in 1972. Secondary audiences include MEAs, the wider UN system of institutions, scientific and professional communities and UN Environment itself. Tertiary audiences are related to emerging audiences and the roll-out of the GEO family of reports on multiple geographical scales and for a number of stakeholders. **Decisions on the future of GEO**

require a careful examination of its intended and unintended audiences and evidence of uptake among them.

Irrespective of decisions taken on the purpose, governance and outputs of GEO, there are a number of universal recommendations to improve outreach and evaluation practices based on past experiences, current best practices from other assessment processes and contemporary tendencies.

Undertaking global environmental assessments requires significant resources and the consideration of both the assessment's cost structure and the sources of financing. One of the enduring features of GEO's budget has been its inherent uncertainty and changing sources. Uncertainty is likely to increase due to the COVID-19 related economic meltdown. While the pandemic is putting national budgets under heavy pressure, there may also be opportunities for cost reduction. **Considering alternative financing models for future GEOs has therefore never been more timely.**

In terms of its cost structure GEO is comparable to some of its GEA peers, but its overall annual cost is significantly lower. All GEOs for which financial data is available have experienced a funding shortfall, at least for part of their process. Such unforeseen – but perhaps foreseeable - funding shortfalls are highly disruptive for the assessment process. While the financing of some GEAs can be considered stable, the funding model of GEO cannot be considered sustainable. While some assessments are limiting the scale of contributions from private sources, significantly broadening the pool of funders is clearly a realistic option, and it may also engage other parts of the audience that may then develop more interest in the assessment's products. **For the future of GEO, alternative funding models must be explored including the proposal to fund GEO through the regular UN Budget or through a dedicated trust fund.**

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Annex 1: The landscape of global MEAs

Source: UN InforMEA 2020

Biological Diversity	Chemicals and Waste	Climate and Atmosphere	Environmental Governance	Land and Agriculture	Marine and Freshwater
Convention on Biological Diversity	Basel Convention	United Nations Framework Convention on Climate Change			International Convention for the Prevention of Pollution from Ships
Convention on International Trade in Endangered Species of Wild Fauna and Flora	*Basel Protocol on Liability and Compensation*	Kyoto Protocol	*Basel Protocol on Liability and Compensation*		
Convention on Migratory Species	Minamata Convention on Mercury	Paris Agreement			
International Plant Protection Convention	Rotterdam Convention	Vienna Convention		International Plant Protection Convention	
Plant Treaty	Stockholm Convention	Montreal Protocol		Plant Treaty	
Nagoya – Kuala Lumpur Supplementary Protocol - Biosafety	*Strategic Approach to International Chemicals Management*	The Kigali Amendment (2016)	*Strategic Approach to International Chemicals Management*	*Nagoya – Kuala Lumpur Supplementary Protocol - Biosafety*	
Cartagena Protocol	*UN Watercourses Convention*	The Beijing Amendment (1999)	*UN Watercourses Convention*	Cartagena Protocol	
Nagoya Protocol		The Montreal Amendment (1997)		Nagoya Protocol	
Ramsar Convention		The Copenhagen Amendment (1992)		Ramsar Convention	Ramsar Convention
United Nations Convention to Combat Desertification		The London Amendment (1990)		*United Nations Convention to Combat Desertification*	
World Heritage Convention				World Heritage Convention	World Heritage Convention

Annex 2: The Structure of GEO from GEO-3 to GEO-6

GEO-3	GEO-4	GEO-5	GEO-6
1 Integrating Environment and Development: 1972–2002 2 State of the Environment and Policy Retrospective: 1972–2002 Socio-economic background Land Forests Biodiversity Freshwater Coastal and marine areas Atmosphere Urban areas Disasters Conclusions 3 Human Vulnerability to Environmental Change 4 Outlook: 2002–32 *Driving forces* A tale of four futures Environmental implications Lessons from the future Technical annex 5 Options for Action	**Section A** Overview Chapter 1 Environment for Development **Section B** State-and-Trends of the Environment: 1987–2007 Chapter 2 Atmosphere Chapter 3 Land Chapter 4 Water Chapter 5 Biodiversity **Section C** Regional Perspectives: 1987–2007 Chapter 6 Sustaining a Common Future **Section D** Human Dimensions of Environmental Change Chapter 7 Vulnerability of People and the Environment: Challenges and Opportunities Chapter 8 Interlinkages: Governance for Sustainability **Section E** The Outlook – Towards 2015 and Beyond Chapter 9 The Future Today **Section F** Sustaining Our Common Future Chapter 10 From the Periphery to the Core of Decision Making – Options for Action	**Part 1**: State and Trends of the Environment Drivers Atmosphere Land Water Biodiversity Chemicals and Waste An Earth System Perspective Review of Data Needs **Part 2**: Policy Options Africa Asia and the Pacific Europe Latin America and the Caribbean North America West Asia Regional Summary **Part 3**: Global Responses Scenarios and Sustainability Transformation Global Responses	CHAPTER 1: Introduction and Context CHAPTER 2: Drivers of Environmental Change CHAPTER 3: The Current State of our Data and Knowledge CHAPTER 4: Cross-cutting Issues **PART A**: STATE OF THE GLOBAL ENVIRONMENT CHAPTER 5: Air CHAPTER 6: Biodiversity CHAPTER 7: Oceans and Coasts CHAPTER 8: Land and Soil CHAPTER 9: Freshwater **PART B**: POLICIES, GOALS, OBJECTIVES AND ENVIRONMENTAL GOVERNANCE: AN ASSESSMENT OF THEIR EFFECTIVENESS CHAPTER 10: Approach to Assessment of Policy Effectiveness CHAPTER 12: Air Policy CHAPTER 13: Biodiversity Policy CHAPTER 14: Oceans and Coastal Policy CHAPTER 15: Land and Soil Policy CHAPTER 16: Freshwater Policy CHAPTER 17: Systemic Policy Approaches for Cross-cutting Issues CHAPTER 18: Conclusions on Policy Effectiveness **PART C**: OUTLOOKS AND PATHWAYS TO A HEALTHY PLANET WITH HEALTHY PEOPLE CHAPTER 19: Outlooks in GEO-6 CHAPTER 20: A Long-Term Vision for 2050 CHAPTER 21: Future Developments Without Targeted Policies

			CHAPTER 22: Pathways Toward Sustainable Development

Annex 3: Interviewed experts

1. *Matthew Billot (UNEP)*
2. *Jason Jabbour (UNEP)*
3. *Jochem Zoetelief (GEF/UNEP)*
4. *Ivar Baste (Norwegian Environment Agency, Norway)*
5. *Nalini Sharma (UNEP)*
6. *Monika Gail MacDevette (UNEP)*
7. *Jacqueline Alvarez (UNEP)*
8. *Tessa Goverse (UNEP)*
9. *Joyeeta Gupta (University of Amsterdam, IHE Delft Institute for Water Education, Netherlands)*
10. *Paul Ekins (University College London, UK)*
11. *Anne Larigauderie (IPBES)*
12. *Hien Ngo (IPBES)*
13. *Terry J. Keating (Environmental Protection Agency, USA)*
14. *Andres Ernesto Guhl Corpas (University of the Andes, Colombia)*
15. *Peter Harris (GRID Arendal, Norway)*
16. *Paul Lucas (Netherlands Environmental Assessment Agency PBL)*
17. *Oksana Tarasova (World Meteorological Organization)*
18. *Juerg Luterbacher (World Meteorological Organization)*
19. *Peter King (IGES, Bangkok Regional Centre, Thailand)*
20. *Gensuo Jia (Chinese Academy of Sciences, China)*
21. *Christian Loewe (German Federal Environment Agency UBA, Germany)*
22. *Sasha Alexander (UNCCD)*
23. *Clarissa Augustinus (UNCCD)*

24. Adriana Ignaciuk (FAO)

25. David Stanners (European Environment Agency, Denmark (retired))

26. Idunn Eidheim (Ministry of Environment of Norway (retired))

27. Ingeborg Mork-Knutsen (Ministry of Environment of Norway)

28. Clever Mafuta (GRID Arendal, Norway)

29. Peter Stoett (University of Ontario Institute of Technology, Canada)

30. Elsa Patricia Galarza Contreras (University of Pacific, Peru)

31. Martin Kowarsch (The Mercator Research Institute on Global Commons and Climate Change, Germany)

32. Carol Hunsberger (University of Western Ontario, Canada)

33. *Ahmed Abdelrehim (The Centre for Environment and Development for the Arab Region and Europe CEDARE, Egypt)*

34. Jochen Flasbarth (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety BMU, Germany)

35. Malini Balakrishnan (The Energy and Resources Institute, India)

36. Maria Ivanova (University of Massachusetts Boston, USA)