Environmental Science and Policy 180 (2026) 104389

Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

Making global environmental assessments fit for future challenges

Håkon B. Stokland [a,*], Alice Vadrot [b], Elizabeth Sanna Barron [c], Silke Beck [d], Marla R. Emery [e], Rolf Lidskog [f], Timo Maas [g,h], Jasper Montana [i], Camilla Sandström [j], Marie Stenseke [k], Andy Stirling [l], Peter Stoett [m], Esther Turnhout [h]

[a] Department of Terrestrial Biodiversity, Norwegian Institute for Nature Research, Trondheim, Norway
[b] Department of Political Science, University of Vienna, Austria
[c] Department of Geography and Social Anthropology, Norwegian University of Science and Technology, Trondheim, Norway
[d] Department of Science, Technology and Society (STS)/ TUM School of Social Sciences and Technology, Technical University of Munich, Germany
[e] United States Forest Service, Research and Development, Burlington, Vermont, USA
[f] Environmental Sociology Section, Örebro University, Sweden
[g] PBL Netherlands Environmental Assessment Agency, The Hague, the Netherlands
[h] Section of Knowledge, Transformation, and Society, University of Twente, the Netherlands
[i] Centre for the Public Awareness of Science, Australian National University, Australia
[j] Department of Political Science, Umeå University, Sweden
[k] Unit for Human Geography, University of Gothenburg, Sweden
[l] Science Policy Research Unit, University of Sussex, United Kingdom
[m] Ontario Tech University, Oshawa, Canada

ARTICLE INFO

Key words:
Global environmental assessments
Science-policy interface
Global environmental change
Social sciences and humanities
Pluralism
Co-production

ABSTRACT

Global environmental assessments (GEAs) provide authoritative expert knowledge on environmental issues for an international audience. Demand for GEAs is growing rapidly: their number is increasing, and their thematic scope continually expands. At the same time, the environmental, social, and political context in which GEAs operate has changed dramatically over their 50-year history. Anthropogenic environmental problems have worsened significantly, while calls for just and equitable transformations are intensifying. In response, GEAs have begun to shift from primarily diagnosing problems to offering solutions and influencing policy, and more recently, towards supporting sustainability transformations. Assessment bodies increasingly recognize that meeting these novel ambitions requires deeper engagement from social sciences and humanities (SSH). However, efforts to include these disciplines have encountered considerable challenges. In this paper, we argue that for GEAs to effectively engage SSH, they must move beyond the prevailing paradigm of environmental assessment based on objectivity, singularity, and linearity, and instead experiment with the plurality and reflexivity of a broader range of knowledges. Such an approach is essential for advancing transformative societal changes. Achieving this requires fundamental reforms to GEA structures and processes. We propose five critical steps for making GEAs more responsive to emerging challenges and more reflexive about their responsibilities within global governance regimes.

1. Introduction

Demand for global environmental assessments (GEAs) and their reports is rising significantly. The IPCC has recently started work on its inventories for short-lived climate forcers and climate change and cities assessments, while IPBES has finalized its nexus and transformative change assessments and will shortly start work on its second global assessment. New GEAs such as the International Panel for Ocean Sustainability (IPOS) and one related to a global plastics treaty are under discussion (Gaill et al., 2022, Singh et al., 2023) and negotiation of a Science-Policy Panel on Chemicals, Waste and Pollution has begun (Allan et al., 2025).

Much has changed in the wider world during the half century or so of GEAs' existence. Growing anthropogenic environmental issues and calls for just and equitable transformations towards sustainability have moved towards center stage on international agendas. The

* Corresponding author.
E-mail address: hakon.stokland@nina.no (H.B. Stokland).

https://doi.org/10.1016/j.envsci.2026.104389
Received 1 July 2025; Received in revised form 16 January 2026; Accepted 23 April 2026

environmental and societal consequences of climate change, biodiversity loss, and pollution are experienced around the world and will accelerate without fundamental changes in political priorities. Meanwhile, the dynamics of multilateral environmental agreement-making, which have recently come under unprecedented pressure with the new US administration, has changed over this period. Previously dominated by Western states and knowledge from their research institutions, growing economies such as China and India, as well as low- and middle-income countries, have acquired stronger, or more visible, voices. This more multipolar picture has intensified negotiations at Conferences of the Parties (COPs) and helped condition 'shrinking' impact from science, with challenges to scientific knowledge and GEAs that scrutinize who funded it and where it was performed (Nature, 2024). At the same time, the importance of knowledges and actions outside of traditional, top-down, and linear science-policy frameworks is increasingly emphasized for facilitating sustainability transformations (Hajer et al., 2015; Beck, 2018; Maas et al., 2021; Turnhout, 2024).

When the first GEAs were established around 50 years ago, their main function was to create an authoritative knowledge base concerning environmental problems that could be employed in policy development. The assessments were mainly based on, and created by, researchers from the natural sciences. The 1977 assessment of Long Range Transport of Air Pollutants (LRTAP) is often seen as the first global environmental assessment and since then numerous GEAs have been completed (Castree et al., 2021 offer a list of 142 reports). Early GEAs had three foundational characteristics: 1) they were predominantly based on data and methodologies from the natural sciences and included a strong role of integrated assessment modeling; 2) they assessed available (mostly natural science) literature to create a comprehensive and authoritative synthesis of environmental problems; and 3) they aimed to inform policy making while maintaining neutrality (Beck, 2018; Castree et al., 2021). These characteristics, and the structures and processes of assessment that were established in the early history of GEAs, form a paradigm that specifies a philosophy of knowledge and associated mode of working based on objectivity, singularity, and linearity.

GEAs based on this traditional paradigm soon found it challenging to provide knowledge "usable" for decision-making on the ground. In response to the perceived gap between research and policy making, GEAs started to focus explicitly on policy relevance, usability and impact, and the assessment of policy solutions has become a common feature in addition to the assessment of the state of environmental trends and drivers of change (Tollefson, 2015; Kowarsch and Jabbour, 2017; Castree et al., 2021; Beck et al., 2022). A second development was the increased recognition of the human dimensions of environmental problems and dynamics. This shift towards solutions and understanding of social aspects led to increasing calls for inclusion of the social sciences and humanities (SSH) in GEAs (Victor, 2015; Larigauderie et al., 2016; Cologna and Oreskes, 2022).

However, efforts to include SSH expertise have been constrained by prevailing structures, processes, and practices inherited from the time when GEAs' function were mainly to facilitate agreement among natural scientists on the biophysical aspects of environmental problems. It is well established that the efforts to integrate SSH in GEAs have encountered considerable challenges (Victor, 2015; Vadrot et al., 2018; Díaz-Reviriego et al., 2019; Stokland et al., 2022). Many SSH participants have experienced difficulties working with GEA structures and processes, as well as unfavorable and imbalanced power relations and social dynamics, both of which have in turn contributed to difficulties in attracting SSH scholars to engage in GEAs (Stokland et al., 2022).

Many commentators have pointed to the limitations of GEAs and have argued that they are in urgent need of innovation (Hulme, 2010; Hulme et al., 2011; Beck et al., 2014; Victor, 2015; Beck, 2018; Díaz-Reviriego et al., 2019; Hughes and Vadrot, 2019; Castree et al., 2021; Maas et al., 2021; DePryck, 2022; Hulme, 2022; Turnhout and Lahsen, 2022; Stokland et al., 2022; Berg and Lidskog, 2024; Hughes, 2024; Turnhout, 2024). However, the two challenges that GEAs face with societal impact and with SSH inclusion are deeply interrelated. Both stem from a mismatch between the paradigm that guided the historical constitution of current GEA structures and processes, and the current context within which GEAs are operating (Fig. 1).

In this paper, we identify how current GEA structures and processes are unfit for future challenges by examining three main aspects of the paradigm that underpins them – *objectivity*, *singularity*, and *linearity*. In each case, we propose concrete steps (five in total) of reform that can make GEAs fit for the future. Such reform will ameliorate important shortcomings of GEAs in fulfilling their function of contributing to effective policymaking through better knowledge and the current, urgent need for transformative change (see also Castree et al., 2021), as well as support the elusive challenge of making SSH more 'at home' in GEAs (a state of epistemic belonging as per Montana, 2021). By taking these steps, GEAs will be better positioned to effectively and fairly deal with existing inequities in knowledge and address the power relations and privilege that keep these in place, to foster genuine knowledge pluralism and inclusiveness, achieve societal legitimacy, and catalyze transformative impacts.

2. Moving beyond the paradigm of objectivity, singularity, and linearity

Foundational characteristics of GEAs form a paradigm that specifies a philosophy of knowledge and associated mode of working based on objectivity, singularity, and linearity. This paradigm is based on a particular notion of objectivity holding that it is possible to distinguish what is observed from the observer. This means that the contents of knowledge are wrongly held to be shaped only by the objects of knowledge and not also partly by characteristics of the subjects (Kuhn, 1962; Funtowicz and Ravetz, 1993; Latour, 2004). This norm of objectivity further enables the synthesis of knowledge since the knowledge that is assessed is seen to directly represent reality in a supposedly singularly definitive fashion. This contrasts with the everyday reality that all objects look different from contrasting angles. Yet such simplistic singularity of understanding leads to assumptions in GEAs that different sources of knowledge can be integrated and accumulated in some unqualified singular way, such as to create a fuller and more comprehensive overview of a reality in which plurality of angles is effectively denied (Stirling, 2011; Turnhout, 2024; Turnhout and Lynch, 2024). Linearity is a third underlying premise of GEAs' philosophy of knowledge. The integrated assessment modeling used in GEAs is based on a linear mechanical framework of causal relations between the drivers of change, the state and impact of problems, and the observed responses and possible solutions. Linearity also forms a mode of working for GEAs based on specific and illusory divisions of labor between science, which produces objective knowledge, and policy, where subjective aspects are allowed (Beck, 2011; Jagannathan et al., 2023).

This paradigm, firmly rooted in the structures and practices of GEAs, constitutes a fundamental barrier to both adequate inclusion of SSH and realization of the potential of GEAs to contribute to societal and environmental change and democratic policy processes. Below we will unpack each of the three aspects of the paradigm – objectivity, singularity, and linearity – highlighting how they hinder SSH inclusion and GEA contributions to society, as well as which steps GEAs can take to adopt a paradigm more aligned with current contexts and able to meet future challenges. Table 1 shows an overview of the paradigm aspects, steps, and associated concrete changes to GEA constitution. The steps are often interrelated, and do not have to be taken sequentially.

3. Objectivity

The notion of objectivity routinely employed in global environmental assessments assumes (often tacitly) that objectivity is unitary, definitive and unconditional. In contrast, it is long established within SSH that all forms of scientific and expert knowledge are neither

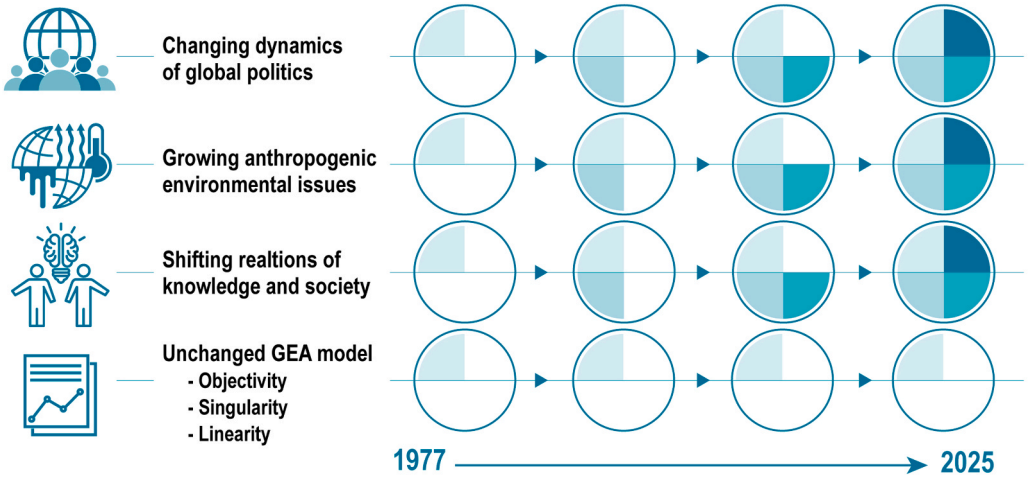

Fig. 1. The GEA paradigm has not changed despite growing anthropogenic environmental issues, changing dynamics of global politics, and shifting relations of knowledge and society. This has led to a mismatch between GEA structures and practices, and the current context within which they are operating.

Table 1
Overview of the paradigm aspects, steps, and associated concrete changes in structures and processes GEAs can adopt to become fit for future challenges.

Paradigm aspect		Steps towards SSH inclusion and societal impact		Concrete changes to GEA constitution	
OBJECTIVITY	1	Definitive objectivity	Reflexive objectivity	Assess and make the contingencies, assumptions and framings of various perspectives and knowledges explicit	An SSH Task Force should be established to help define which particular mechanisms and reforms these steps entail within the context of each specific GEA
	2	Neutral knowledge	Explicitly political knowledge	Assess and make the political aspects and implications of various knowledges explicit	
SINGULARITY	3	Consensus	Pluralism	Acknowledge and detail conflicting knowledges, and avoid forced integration between non-commensurable knowledge forms	
	4	Universal syntheses	Context-sensitive syntheses	Acknowledge and detail how knowledge, problems, and solutions are situated in diverse socio-spatial settings	
LINEARITY	5	Government-oriented relevance	Co-productive impact	Enable more meaningful participation in assessment processes for wider groups of stakeholders	

universally objective nor value-free (e.g. Kuhn, 1962; Haraway, 1988; Funtowicz and Ravetz, 1993; Latour, 2004). Rather, knowledge is produced within established knowledge systems, where particular rules and expectations about its production and use define the facts that come to matter. Across different disciplines and knowledge systems, different questions are worth asking and different methods worth applying. In short, all knowledge contains assumptions, framings and contingencies that inevitably affect what facts it brings to the table (Stirling, 2010; Turnhout, 2018). These facts are thus always partial and often incommensurable.

3.1. Step 1: from definitive to reflexive objectivity

The conception of objectivity as unitary, definitive and unconditional contrasts with notions that objectivity can be plural (manifest in multiple equally valid but conditional forms), uncertain (subject to irreducible indeterminacies) and conditional (shaped not only by what is in focus, but also by subjective contexts of observation) (Stirling, 2008). As an everyday example, 'objective' pictures of how material items relate to each other in a room (eg: above or below, to the left or right), can be recognized to vary depending on the angles from which they are viewed. Such a notion does not deny that objects are physically present, just that their overall configurations can be represented in a variety of different ways that are equally legitimate in principle.

A further aspect of the aspired definitive objectivity is an understanding of the observer as transcendent of her own context (as when viewing constellations of distant stars in the sky). This is a valid notion in

astronomy, where foci of attention are typically ontologically remote from conditions of attention. But this is not necessarily true where - as in GEAs - crucial societal factors under scrutiny are highly proximate with institutional, political and cultural conditions bearing on processes of scrutiny themselves (Borie et al., 2021). In such a case of immersion of subjects among objects, the situation is more like the everyday experience where arrangements of items in a room look different from contrasting angles. Here, objectivity is still possible, but must be reflexive, plural and conditional in its care to accompany any given picture with explicit attention to the angle from which it was viewed.

Known as 'parallax' (Stirling, 2019), this contrasting appearance of the same concrete reality from different angles is a crucial feature of the everyday world that is downplayed in high-stakes policy analysis only because of pressures for justification (Boltanski and Thévenot, 2006). The point at issue is not about 'postmodern' 'post truth' 'relativism', but simply an understanding of the necessity to be as rigorous about attending reflexively to multiple perspectives as to accuracy within the pictures that they each yield. In this sense, reflexivity is not (as sometimes unfortunately implied, like objectivity) itself some kind of transcendent quality somehow achievable by a particular enlightened perspective (Stirling, 2006). Such assertions are, again, reflective of pressures of patronage-for-justification in policy processes (Stirling, 2016). Instead, this more holistic collective property of a distributed reflexivity among diverse perspectives, arises not despite the messiness, disparities and incoherence of an assemblage of views, but because of them (Wynne, 2005). Here it is as much about rigour as reflexivity, that clarity concerning conditionalities is as important as the plurality itself (Stirling, 2008). To increase reflexivity of the knowledge processed and presented by GEAs in this way, we suggest that they become more aware of, and explicit about, the contingencies, assumptions and framings of various perspectives and knowledges. Investigations in such a 'plural and conditional' style should be adopted as an inherent part of the assessment process.

3.2. Step 2: from neutral to explicitly political knowledge

Grounded in a notion of definitive objectivity, most GEAs explicitly adhere to an ideal of neutrality and a self-imposed restriction to avoid policy prescription.[1] This approach stems from their historical context, is firmly rooted within the natural sciences, and aligns with depoliticization logics in other international organizations (Louis and Maertens, 2021). However, it contrasts with established notions in SSH that no forms of scientific or expert knowledge are value-free (Funtowicz and Ravetz, 1993; Latour, 2004). Knowledges are always partial, and the ways in which they are partial matter. The configuration and choices of particular contingencies, assumptions, and framings typically influence the implications of knowledge for policy development (Turnhout, 2024). That is, different framings and assumptions will lead to knowledge that favors different policy options over others, and thus also some sets of actors at the expense of others (Stokland et al., 2023). This means that knowledge is always inherently political. This understanding contrasts sharply with the assumption that objective synthesis of scientific knowledge implies a self-imposed restriction to avoid policy prescription. Rather, if we take knowledge to have political implications, GEAs are indeed indirectly prescriptive due to the framings, assumptions and contingencies of the knowledge they highlight, and their exclusion or marginalization of alternative knowledges. We suggest that GEAs could strive to assess and make the political aspects and implications of different knowledges explicit (Castree et al., 2021). In this way, GEAs could nurture open, democratic deliberation about contrasting knowledges and their implications for policy development. In the current GEA approach, which insists on claiming neutrality, the risk is rather that such deliberation is short-circuited by the presentation of knowledge as apolitical (Latour, 2004; Jasanoff and Simmet, 2017). Crucially, we recognize and emphasize that this shift to explicitly political knowledge requires a parallel change in wider expectations of what GEA knowledge can do for policymaking (Maas et al., forthcoming), while noting that the fact that many GEAs have an intergovernmental character provides a unique opportunity to actually realize such concurrent shifts.

[1] This applies to GEAs such as IPCC and IPBES, but there are also exceptions. For example, UNEP's Global Environment Outlook 6 included policy recommendations.

4. Singularity

Singularity, or the assumption that it is possible and advantageous to arrive at a unitary, comprehensive, and value-free viewpoint based on synthesis of diverse knowledges, dominates GEAs' understanding and engagement with environments and their social entanglements. This is a consequence of the aspired definitive objectivity described above, and manifests in the pursuit of integrative and universal knowledge syntheses. This contrasts with much recent SSH scholarship that emphasize the necessity to engage in a pluralistic way with multiple ontologies and knowledges in environmental issues (Stirling, 2011; Escobar, 2018; Aspøy and Stokland, 2022; Turnhout and Lynch, 2024). The following two steps would enable GEAs to move beyond singularity in terms of consensus-based and universal syntheses, respectively.

4.1. Step 3: from consensus to pluralism

To varying degrees, GEAs attempt to be inclusive of diverse disciplines and knowledge systems. IPBES is widely recognized as one of the leading GEAs in this effort. Yet, mechanisms for including this diversity are not complete nor perfect. For example, an evaluation of inclusion of Indigenous and Local Knowledge (ILK) in IPBES reports (White and Lidskog, 2023) found that diverse perspectives were dealt with in one of three ways: Either assessments focused on 'the facts', sidelining knowledges that were not compatible; Or assessments sought to bridge worldviews by showing a diversity of different perspectives that none the less offer complementary support for one another's insight; Or assessments focused on presenting 'what works', focusing on the most relevant knowledge for addressing a particular issue.

More generally, the approach taken in GEAs to include SSH (and ILK) reflects a 'bigger tent' mentality, in which knowledge from SSH is seen as an add-on to the science, technology, engineering, and mathematics (STEM) literature. Synthesis, then, takes the form of consensus and integration in which diverse forms of knowledge are seen as complementary pieces of a singular puzzle. While GEAs can acknowledge diverging evidence on a topic, there is little room for experts to disagree or express dissent with assessments' framings or conclusions outside of internal assessment processes (Montana, 2021). Particularly when these diverse forms of knowledge are in tension or reflect different incompatible paradigms (Stirling, 2011), this becomes problematic. In those cases, integration and consensus can only be achieved through the exercise of power and by glossing over diverging perspectives (Beck et al., 2014; Lövbrand et al., 2015). And, since GEA processes and structures are based on the paradigm of objectivity, singularity, and linearity, there is a considerable risk that alternative paradigms, disciplines and knowledge systems end up being coopted, marginalized or excluded, resulting in epistemic injustices.

In response to these problems, a pluralist approach in which different disciplines and knowledge systems can contribute on their own terms would yield significantly more robust and useful knowledge assessments. In a way that can in principle be as open to quantitative as qualitative approaches (Stirling 2007), such assessments would ideally present a smorgasbord of both complementary and contradictory approaches that can be adapted and adjusted to local contexts. Policymakers can then engage in comprehensive, society-wide deliberations, tailoring solutions to specific needs rather than relying on a single, unified solution. Such pluralist assessments would also be clear on why

various knowledge forms differ, in line with the steps discussed above, as well as where conflict lies among different forms of knowledge (Hulme, 2015).

Pluralism requires that GEAs move away from a focus on producing "state of the art consensus knowledge" (Larigauderie and Mooney, 2010: 12) towards a more agonistic approach (e.g. Mouffe, 2005) in which conflicting viewpoints are actively acknowledged as a model of global expert authority (White and Lidskog, 2023). For example, in what ways, why, and with which political implications do ecological monitoring activities conflict with analyses of social justice in a particular setting? Research suggests that important value conflicts can be found at the intersections of disciplinary thought (Sarewitz, 2004). Understanding and acknowledging these politics of knowledge can help reveal important value conflicts that may need to be worked out politically by policy makers in attempting to tackle environmental challenges, rather than being covered up by integrative synthesis. These conflicts should not be listed as issues to be necessarily solved by more research, but rather as sites where political work might need to be done to navigate value conflicts in the world more broadly. The task of GEAs would then be to offer a platform that highlights dissensus and, thus, enables political and democratic deliberation processes.

4.2. Step 4: from universal to context-sensitive syntheses

Most GEAs are global in scope, or targeting large regions of the globe. This rests on the assumption that knowledge can be synthesized quantitatively and generalized across different social and spatial contexts. However, much of the knowledge crucial for sustainable solutions and transformations towards sustainability is context-dependent and place-specific (Boström and Lidskog, 2024). For example, Weber et al. (2015) demonstrated how a trade ban on polar bear parts and products, motivated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), failed to take into account knowledge on how it would affect the specific social context it implicated. The ban negatively impacted the livelihoods of Arctic indigenous communities and reduced local participation in shared management initiatives, while failing to decrease total harvest. The social context-dependency of knowledges is mainly emphasized by SSH, while their place-specific character is also acknowledged by some other disciplines (e.g. ecology). Although synthesis across spatial and social contexts is possible, simply aggregating SSH knowledge quantitatively to produce a generalized and universal synthesis is problematic as it compromises the contextual socio-economic specificities that make such knowledge valid. By pursuing this type of synthesis, GEAs risk not only ignoring or marginalizing aspects that ensure validity, but also misrepresenting the political implications of the knowledge.

The aggregation into universal syntheses often obstructs opportunities to relate SSH knowledge to other place-based knowledge to identify solutions for sustainable ways forward. By emphasizing macro-social solutions, such as international agreements and measures (such as new technologies) to be applied globally, current GEA practices of aggregating knowledge also involve a misunderstanding of global-local relations and a restricted view of agency (O'Brien et al., 2023). Local actions, lifestyle changes, and even national actions are often framed as largely symbolic, while the most important decisions and actions are assumed to occur at the international level, driven by powerful actors such as states and transnational corporations. However, global environmental challenges are the result of a complex web of interactions that no single actor, not even the most powerful nation-state or transnational corporation, can control alone. Instead, agency is largely distributed, that is, constructed in networks and assemblages of people, organizations, norms, and technologies (Latour, 2005, Enfield and Kockelman 2017, Lidskog and Standring, 2023).

In our view, GEAs should be more explicit and reflexive about the contextual character of the knowledge they assess. Aggregating knowledge, constructing models and identifying trends are valuable, but they must be carried out in ways that acknowledge that both problems and solutions are situated in diverse socio-spatial settings. It is crucial that GEAs do not lose sight of the very different ways in which people and places are affected by global environmental change, and how knowledges, proposed measures, and solutions are both shaped by and shaping socio-spatial settings. Thereby, GEAs can also better support initiatives and work at national and local levels.

5. Linearity

GEAs are typically shaped around a rather mechanistic and linear framework of causal relations between the drivers of change, the state and impact of problems, and the responses and solutions. The structures, processes, and relations to wider society of GEAs were designed to function within this framework, and are based on specific and illusory divisions of labor between science, which produces objective knowledge, and policy, where subjective aspects are allowed (Beck, 2011; Jagannathan et al., 2023; Turnhout, 2024).

5.1. Step 5: from government-oriented relevance to co-productive impact

Typically, GEAs have an internal governance structure that is intergovernmental, in which plenary sessions of member states decide on a programme of work and approve assessments for publication. Similarly, national governments and the multilateral fora in which they engage are usually understood as the main beneficiaries of the assessments. In other words, the relevance of GEAs is seen to lie in providing globalized knowledge for globalized and state-led governance (Turnhout et al., 2016). But this one-sided focus of GEA relevance risks foregoing other avenues for change (Hajer et al., 2015; Beck, 2018). Responding to calls for transformative action that is 'whole-of-government' and 'whole--of-society' therefore necessitate GEAs to reconsider who is intended to benefit from an assessment, and what makes the chosen scope and approach fit-for-purpose (Maas et al., 2021).

Operationalizing an expansion from government-orientation to plural audiences requires meaningful participation of stakeholders. Although opportunities currently exist for non-state actors to participate, review and comment in assessment processes, their influence on the envisioned use of assessments is limited. A co-productive approach, which recognizes knowledge and action as entwined and blurs the distinction between experts and users, would allow for the active engagement of diverse actors beyond governments throughout the assessment process. In this regard, the previously mentioned shift from integrative to pluralist syntheses can also be instructive. For example, adopting a pluralist approach to an assessment already in its scoping phase can maintain the visibility of stakeholder perspectives that are currently marginalized and enable assessments to deal with contestation and incommensurability from the get-go (Diaz-Reviriego et al., 2019). In contrast to the current linear approach of GEAs, a plural and co-productive approach would support the impact of assessments by ensuring that their content would be more actionable and relevant (see the point about context specific syntheses), as well as empowering non-governmental actors to hold governments accountable.

6. Discussion

Regardless of the direction GEAs will take in the future, they will undoubtedly face challenges, not least that of maintaining scientific authority while pursuing policy relevance (cf. Asayama et al., 2023). It remains the case that GEAs and the global governance regime of multilateral environmental agreements have a functional role as foundations for an as-yet incomplete global constitutional order - a set of shared institutions and processes that define what is worth protecting, what is just action, and what is deemed truthful at the global scale (Jasanoff, 2013). Moving forward with caution is therefore vitally important, and developing GEAs in line with the proposed steps will

require careful navigation.

Firstly, more pluralist and heterogeneous knowledge assessments will make it more difficult to synthesize and single out core messages. The increased efforts to engage with complexity, uncertainty, dilemmas, and ambivalence required by reflexivity can be very demanding. It will require considerable self-criticism, including reflection on GEAs' own epistemic assumptions and political aspects, as well as an openness to multiple actors to be able to raise novel questions and to critically evaluate and contest recommendations from GEAs (Boström et al., 2024). A way forward might be to emphasize the inclusion of reflexivity in concepts already recognized in the GEAs, such as adaptation and mitigation. Much of this is likely to challenge the assumptions of governments about what GEAs are for. In addition, many GEA organization bodies and governments consider assertions of objectivity as a strategic measure to claim political neutrality and gain legitimacy (Louis and Maertens, 2021). However, to maintain widespread commitment by governments to fund and participate in GEAs, it is crucial that governments recognize the purpose of these changes and are supported in re-defining their relationship to global environmental expertise. Governments will need to move away from an expectation that GEAs produce universally applicable and consensus-based key messages and, along with assessment participants, will need to help communicate these changed expectations to their citizens (Maas et al., forthcoming).

Secondly, explicitly acknowledging and assessing contingencies, assumptions, framings, and political implications of various knowledges, as well as emphasizing conflicting and non-commensurable knowledges in a pluralist way, will make it easier for actors to contest the credibility and authority of assessments (Beck, 2011). The reforms of structures and processes proposed in this paper would improve GEAs contributions to strengthening the knowledge capabilities and reflexive capacities of actors, promoting more informed deliberation and debate, and challenging unequal power-relations. Inclusion of SSH on its own terms in assessments is also likely to involve criticism of existing and dominant ways of thinking and acting, which can create more space for people and organizations to act creatively and in a transformative way. However, like democratic processes such as including the voices of women, ethnic groups, and other marginalized people, deliberation is seen as a less valid argument among a significant share of the governments that constitute the members of GEAs. Combined with the explicit reflexivity discussed above, this could open space for deliberate contestation and strategic action by powerful actors (including authoritarian governments) aiming to preserve status quo, vested interests, and their positions. Such actors could seek to take advantage of explicit statements about the political aspects and epistemic assumptions of knowledge, claiming that this disqualifies the knowledge from guiding political action. Similar developments have occurred in the case of climate denialism (Bowden et al., 2021). In our view, what is needed to achieve transformation in such situations is not unitary, apolitical and universal knowledge delivered from a GEA. Firstly, this is not of itself likely to shift existing power-relations or the structures that hold them in place. Secondly, this 'technocratic' style may alienate marginalized actors from actively engaging with knowledge from GEAs and relating it to their own situation and (in)ability to contribute to change (Jasanoff and Simmet, 2017). Albeit inadvertent, such a technocratic style can itself embody a kind of authoritarianism, that can act to provoke and reinforce wider forms of authoritarianism, which not only obstruct but reverse the intended aims (Stirling, 2023). Contributing to transformation in the face of powerful actors that resist is not a task that GEAs can accomplish alone. What they can do, however, is to open up a potential space for democratic deliberation of different knowledges, perspectives, and how they relate to various political choices and ways forward.

To implement the steps we propose above for making GEAs fit for future challenges, a dedicated approach along with appropriate resources is needed to define what these steps entail within the context of each specific GEA. For example, what needs to change for IPCC to allow for more context-sensitive syntheses, and for IPOS to explicitly assess the political aspects of knowledge? It should also be noted here that some GEAs have initiated some efforts in line with some of the steps we propose. We suggest that GEAs should establish Task Forces dedicated to SSH, whose job it is to consider more concretely appropriate mechanisms and reforms for the contribution of SSH to the assessments. These Task Forces should be allocated resources on the same level as other Task Forces. Their work may include an explicit methodological assessment on the inclusion of critical and interpretive social science, or social theory more broadly, which are currently by and large sidelined from assessments.

7. Conclusion

For GEAs to effectively include SSH, and advance their recent engagement to assess policy options and transformative change, they must move beyond the traditional paradigm of environmental assessment based on objectivity, singularity, and linearity. This shift requires fundamental reforms to GEA structures and processes that can be pursued through the five steps proposed in this paper. These reforms will not be easy to accomplish, but they are essential for making GEAs more responsive to current context and future challenges, as well as more reflexive of their own role and responsibilities in society.

CRediT authorship contribution statement

Camilla Sandström: Writing – review & editing, Conceptualization. **Jasper Montana:** Writing – review & editing, Conceptualization. **Andy Stirling:** Writing – review & editing, Conceptualization. **Marie Stenseke:** Writing – review & editing, Conceptualization. **Esther Turnhout:** Writing – review & editing, Conceptualization. **Alice Vadrot:** Writing – review & editing, Project administration, Conceptualization. **Peter Stoett:** Writing – review & editing, Conceptualization. **Håkon B. Stokland:** Writing – review & editing, Writing – original draft, Project administration, Conceptualization. **Silke Beck:** Writing – review & editing, Conceptualization. **Elizabeth Sanna Barron:** Writing – review & editing, Conceptualization. **Timo Maas:** Writing – review & editing, Conceptualization. **Rolf Lidskog:** Writing – review & editing, Conceptualization. **Marla R. Emery:** Writing – review & editing, Conceptualization.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The corresponding author and 7 out of 12 co-authors have been involved as authors in IPBES assessments. The corresponding author is involved in the organizing team of the Social Sciences and Humanities Network related to IPBES. One co-author has been involved in the IPBES Multidisciplinary Expert Panel. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Data availability

No data was used for the research described in the article.

References

Allan, J.I., Borthakur, Anwesha, Kinninburgh, Fiona, Petersmann, Moritz, Balayannis, Angeliki, Barry, Andrew, Beck, Silke, Elliott, Kevin, Forsyth, Tim, Hardon, Anita, Hughes, Hannah, Macnaghten, Philip, Selin, Henrik, Sun, Yixian, Vadrot, Alice, 2025. Rethinking the science-policy interface for chemicals, waste, and pollution: challenging core assumptions. Glob. Environ. Change-Hum. Policy Dimens. 92.

Asayama, S., et al., 2023. Three institutional pathways to envision the future of the IPCC. Nat. Clim. Change.

Aspøy, H., Stokland, H., 2022. Segmented forest realities: the ontological politics of biodiversity mapping. Environ. Sci. Policy 137, 120–127.
Beck, S., 2011. Moving beyond the linear model of expertise? IPCC and the test of adaptation. Reg. Environ. Change 11 (2), 297–306.
Beck, S., et al., 2014. Towards a reflexive turn in the governance of global environmental expertise the cases of the IPCC and the IPBES. Gaia-Ecol. Perspect. Sci. Soc. 23 (2), 80–87.
Beck, S., 2018. The politics of anticipation: the IPCC and the negative emissions technologies experience. Glob. Sustain. 1 (8).
Beck, S., Forsyth, T., Mahony, M., 2022. Urgent need to move toward solution-orientated environmental assessments. One Earth 5 (6), 586–588.
Berg, M., Lidskog, R., 2024. Global environmental assessments and transformative change: the role of epistemic infrastructures and the inclusion of social sciences. Innov. Eur. J. Soc. Sci. Res.
Boltanski, L., Thévenot, Laurent, 2006. On Justification: Economies of worth. Princeton University Press, Princeton.
Borie, M., et al., 2021. Knowing like a global expert organization: comparative insights from the IPCC and IPBES. Glob. Environ. Change-Hum. Policy Dimens. 68.
Boström, M., Berg, M., Lidskog, R., 2024. In: Overdevest, C. (Ed.), Reflexivity and anti-reflexivity, in Elgar Encyclopedia of Environmental Sociology. Edward Elgar, Cheltenham, UK, pp. 474–480 (p.).
Boström, M., Lidskog, R., 2024. Environmental Sociology and Social Transformation. Routledge, London.
Bowden, V., Nyberg, D., Wright, C., 2021. I don't think anybody really knows": constructing reflexive ignorance in climate change adaptation. Br. J. Sociol. 72 (2), 397–411.
Castree, N., Bellamy, R., Osaka, S., 2021. The future of global environmental assessments: making a case for fundamental change. Anthr. Rev. 8 (1), 56–82.
Cologna, V., Oreskes, N., 2022. Don't gloss over social science! a response to: glavovic et al. (2021) 'the tragedy of climate change science. Clim. Dev. 14 (9), 839–841.
DePryck, K.H., 2022. Critical Assessment of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK.
Diaz-Reviriego, I., Turnhout, E., Beck, S., 2019. Participation and inclusiveness in the intergovernmental science-policy platform on biodiversity and ecosystem services. Nat. Sustain. 2 (6), 457–464.
Escobar, A., 2018. Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds. Duke University Press, Durham.
Funtowicz, S.O., Ravetz, J.R., 1993. Science for the post-normal age. Futures 25 (7), 739–755.
Gaill, F., Brodie Rudolph, T., Lebleu, L., et al., 2022. An evolution towards scientific consensus for a sustainable ocean future. npj Ocean Sustain 1 (7).
Hajer, M., et al., 2015. Beyond Cockpit-ism: four Insights to Enhance the Transformative Potential of the Sustainable Development Goals. Sustainability 7 (2), 1651–1660.
Haraway, D., 1988. Situated knowledges - the science question in feminism and the privilege of partial perspective. Fem. Stud. 14 (3), 575–599.
Hughes, H., 2024. The IPCC and the Politics of Writing Climate Change. Cambridge University Press, Cambridge, UK.
Hughes, H., Vadrot, A.B.M., 2019. Weighting the world: IPBES and the struggle over biocultural diversity. Glob. Environ. Polit. 19 (2), 14–37.
Hulme, M., 2010. Problems with making and governing global kinds of knowledge. Glob. Environ. Change-Hum. Policy Dimens. 20 (4), 558–564.
Hulme, M., et al., 2011. Science-policy interface: beyond assessments. Science 333 (6043), 697–698.
Hulme, M., 2015. In: K.a.L. Bäckstrand, E. (Ed.), Knowledge Pluralism., in Research Handbook on Climate Governance. Edward Elgar Publishing Limited, Cheltenham, pp. 555–565.
Hulme, M., 2022. *Scientific Consensus-seeking*, in *Critical a*. In: K.H. DePryck, M. (Ed.), ssessment of the intergovernmental panel on climate change. Cambridge University Press: Cambridge, UK.
Jagannathan, K., et al., 2023. A research agenda for the science of actionable knowledge: Drawing from a review of the most misguided to the most enlightened claims in the science-policy interface literature. Environ. Sci. Policy 144, 174–186.
Jasanoff, S., 2013. A world of experts: science and global environmental constitutionalism. Boston Coll. Environ. Aff. Law Rev. 40 (2).
Jasanoff, S., Simmet, H.R., 2017. No funeral bells: public reason in a "post-truth' age. Soc. Stud. Sci. 47 (5), 751–770.
Kowarsch, M., Jabbour, J., 2017. Solution-oriented global environmental assessments: Opportunities and challenges. Environ. Sci. & Policy 77, 187–192.
Kuhn, T.S., 1962. The Structure of Scientific Revolutions. University of Chicago Press, Chicago.
Larigauderie, A., Mooney, H.A., 2010. The Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services: moving a step closer to an IPCC-like mechanism for biodiversity. Curr. Opin. Environ. Sustain. 2 (1-2), 9–14.
Larigauderie, A., Stenseke, M., Watson, R.T., 2016. IPBES reaches out to social scientists. Nature 532 (7599), p. 313-313.
Latour, B., 2004. Politics of Nature: How to Bring the Sciences Into Democracy. Harvard University Press, Cambridge.
Latour, B., 2005. Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford University Press, Oxford.
Lidskog, R., Standring, A., 2023. Accountability in the environmental crisis: from microsocial practices to moral orders. Environ. Policy Gov. 33 (6), 583–592.
Louis, M., Maertens, L., 2021. Why International Organizations Hate Politics: Depoliticizing the World. Routledge, New York.
Lövbrand, E., et al., 2015. Who speaks for the future of Earth? How critical social science can extend the conversation on the Anthropocene. Glob. Environ. Change-Hum. Policy Dimens. 32, 211–218.
Maas, T.Y., et al., 2021. Effectively empowering: a different look at bolstering the effectiveness of global environmental assessments. Environ. Sci. Policy 123, 210–219.
Maas, T.Y., Pauwelussen, A., & Turnhout, E. (forthcoming) *Politicizing expertise for Dutch Broad Wellbeing: Knowledge accountability for transformative change*. Science, Technology and Human Values.
Montana, J., 2021. From inclusion to epistemic belonging in international environmental expertise: learning from the institutionalisation of scenarios and models in IPBES. Environ. Sociol. 7 (4), 305–315.
Mouffe, C., 2005. On the political. Routledge, New York.
Nature, 2024. Good COPs, bad COPs: science struggles in a year of environmental summits. Nature 636 (8043), 521–522.
O'Brien, K., et al., 2023. Fractal approaches to scaling transformations to sustainability. Ambio 52 (9), 1448–1461.
Sarewitz, D., 2004. How science makes environmental controversies worse. Environ. Sci. Policy 7 (5), 385–403.
Singh, G.G., Harden-Davies, H., Swartz, W., et al., 2023. An international panel for ocean sustainability needs to proactively address challenges facing existing science–policy platforms. npj Ocean Sustain 2, 21.
Stirling, A., 2006. Precaution, foresight and sustainability: reflection and reflexivity in the governance of science and technology. In: Voß, J.-P., Bauknecht, Dierk, Kemp, René (Eds.), Reflexive governance for sustainable development. Edward Elgar Publishing: Cheltenham.
Stirling, A., 2008. Opening up" and "Closing down" - Power, participation, and pluralism in the social appraisal of technology. Sci. Technol. Hum. Values 33 (2), 262–294.
Stirling, A., 2010. Keep it complex. Nature 468 (7327), 1029–1031.
Stirling, A., 2011. Pluralising progress: from integrative transitions to transformative diversity. Environ. Innov. Soc. Transit. 1 (1), 82–88.
Stirling, A., 2016. Knowing doing governing: realizing heterodyne democracies. In: Voß, J.-Pa.R.F. (Ed.), Knowing governance: The epistemic construction of political order. Palgrave Macmillan UK, London, pp. 259–289.
Stirling, A., 2019. How deep is incumbency? A 'configuring fields' approach to redistributing and reorienting power in socio-material change. Energy Res. Soc. Sci. 58.
Stirling, A., 2023. Against misleading technocratic precision in research evaluation and wider policy-A response to Franzoni and Stephan (2023), 'uncertainty and risk-taking in science. Res. Policy 52 (3).
Stokland, H.B., et al., 2023. Warranty for a better world? The politics of environmental knowledge in bioeconomic sustainability certificates. Ambio 52 (6), 1056–1064.
Stokland, H.B., Stenseke, M., Emery, M.R., 2022. A network to enhance the contributions from the social sciences and humanities to IPBES. Ecosyst. People 18 (1), 95–98.
Tollefson, J., 2015. Climate-panel chief hoesung lee wants focus on solutions. Nature.
Turnhout, E., 2018. The politics of environmental knowledge. Conserv. Soc. 16 (3), 363–371.
Turnhout, E., 2024. A better knowledge is possible: transforming environmental science for justice and pluralism. Environ. Sci. Policy **155**.
Turnhout, E., Dewulf, A., Hulme, M., 2016. What does policy-relevant global environmental knowledge do? The cases of climate and biodiversity. Curr. Opin. Environ. Sustain. 18, 65–72.
Turnhout, E., Lahsen, M., 2022. Transforming environmental research to avoid tragedy. Clim. Dev. 14 (9), 834–838.
Turnhout, E., Lynch, C.R., 2024. Raising the carbonized forest: science and technologies of singularization. Environ. Plan. F.
Vadrot, A.B.M., et al., 2018. Why are social sciences and humanities needed in the works of IPBES? A systematic review of the literature. Innov. Eur. J. Soc. Sci. Res. 31, S78–S100.
Victor, D.G., 2015. Embed the social sciences in climate policy. Nature 520 (7545), 27–29.
Weber, D.S., Mandler, T., Dyck, M., Van Coeverden De Groot, P.J., Lee, D.S., Clark, D.A., 2015. Unexpected and undesired conservation outcomes of wildlife trade bans — an emerging problem for stakeholders? Glob. Ecol. Conserv. 3, 389–400.
White, J.M., Lidskog, R., 2023. Pluralism, paralysis, practice: making environmental knowledge usable. Ecosyst. People 19 (1).
Wynne, B., 2005. Reflexing complexity - Post-genomic knowledge and reductionist returns in public science. Theory Cult. Soc. 22 (5), p. 67-+.