



# Working the boundary: science–policy interactions and uneven knowledge politics in IPBES

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## Abstract

The rising demand for policy-relevant knowledge has supported the emergence of global boundary organizations at the science–policy interface. By synthesizing environmental knowledge for policy-makers, boundary organizations influence how we know and govern sustainability challenges. Therefore, it is essential to better understand what happens in and through these organizations. This paper examines the very practices that configure science–policy relations in global boundary organizations by studying the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Through Science and Technology Studies (STS) and Political Ecology perspectives, we disclose mechanisms of boundary work that demarcate science from non-science and, hereby, determine which expertise becomes authoritative in IPBES. Building on original empirical data, we first examine how science and policy domains were interrelated during the IPBES global assessment process (2016–2019). Second, we investigate how this boundary work shaped the production of biodiversity knowledge. Our findings indicate that integration and demarcation efforts configured science–policy relations through formalized and informal mechanisms. We argue that this boundary work continuously established science as authoritative voice for addressing biodiversity loss in IPBES. Spatial aspects of boundary work highlight power differentials between IPBES member States that manifested in uneven geographies of knowledge. Instead of concealing these inequalities through the norm of political neutrality, we need to recognize boundary organizations as political spaces in which science and policy are co-produced. By adopting a critical and reflexive co-productionist approach, it becomes possible to address uneven knowledge–power relations through more inclusive and transparent practices. Boundary organizations, such as IPBES, are then able to provide more diversified environmental explanations and transformative solutions.

**Keywords** Science–policy interface · Boundary organization · Co-production · Boundary work

## Introduction

The rising demand for policy-relevant environmental knowledge has supported the emergence of global organizations at the interface of science and policy (Beck et al. 2014a). Such organizations are often referred to as ‘boundary organizations’ (Guston 1999, 2001) and include prominent examples like the Intergovernmental Panel on Climate Change

(IPCC) or Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Boundary organizations play a key role in solving complex sustainability issues, as they provide knowledge for decision-makers—often through environmental assessments (Beck et al. 2014a). Through their intermediary role, boundary organizations frame and construct environmental challenges in politically meaningful ways (c.f. Forsyth 2004). Consequently, we need to better understand what happens in and through these organizations before further endorsing boundary organizations as epistemic and political authorities in environmental governance (c.f. Beck et al. 2014a, p. 81),

Previous research has shown that boundary organizations often conform to the linear model of expertise, which has important implications for how we know and govern sustainability issues (e.g., Beck 2011; Grundmann and Rödder 2019 for the case of the IPCC). Through this linear model,

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boundary organizations promote the image of a stable and predetermined science–policy boundary, which needs to be crossed to facilitate knowledge transfer between science and policy. From this perspective, science gains authority by providing objectively true, universal, and apolitical knowledge to policy-makers and the wider public.

A linear understanding of science–policy relations is problematic, as “politically relevant questions are framed and addressed in a very abstract, disembodied, and non-political way” (Beck 2011, p. 302). This conceals the fact that environmental knowledge production presents a highly contested process shaped by uneven participation and power dynamics (e.g., Goldman et al. 2018; Turnhout 2018). Masking these uneven politics of knowledge depoliticizes issues such as climate change or biodiversity loss and obscures the more complex and dynamic interactions between science and policy. As Science and Technology Studies (STS) and Political Ecology research has shown, science–policy relations are neither linear nor static. Instead, they are continuously maintained, shifted, and negotiated through boundary work (e.g., Beck et al. 2017; Goldman et al. 2011; Jasanoff 1990). Boundary work demarcates science from non-science, assigns places for science and policy, and, therefore, determines which expertise becomes legitimate and authoritative in specific contexts. Hence, mechanisms of boundary work facilitate the emergence of dominant and selective environmental representations that enable or constrain particular policy options (Beck and Mahony 2018).

Despite these critical debates promoting a more processual and nuanced understanding of science–policy relations, the linear model of expertise is still prominent in guiding the design of global boundary organizations like IPBES, which serves us as case study. In 2012, IPBES was established to strengthen the science–policy interface for biodiversity and ecosystem services. One of its primary objectives is to synthesize the state of knowledge about biodiversity and ecosystem services for policy-makers through environmental assessments (IPBES 2012). By aiming to provide environmental assessments that are “comprehensive and objective and remain neutral with respect to policy” (IPBES 2015, p. 20), IPBES promotes the ideals of political neutrality and scientific objectivity. This indicates that IPBES conforms to linear model thinking (e.g., Borie 2016; De Donà and Linke 2022; Gustafsson et al. 2019; Koetz et al. 2012; Lahsen and Turnhout 2021; Raina and Dey 2020; Turnhout et al. 2014; Turnhout and Purvis 2020).

In this paper, we contest this linear model of expertise by challenging the notions of political neutrality and scientific objectivity in boundary organizations, exemplified by IPBES. To this end, we empirically analyze the IPBES global assessment process (2016–2019) through the lens of boundary work. Our main objective is to better understand how science–policy boundaries are maintained, shifted, and

negotiated and what this implies for the production of biodiversity knowledge in IPBES. Drawing on STS and Political Ecology perspectives, we first explore the mechanisms that assigned places for science and policy during the IPBES global assessment process. Second, we disclose how this boundary work regulated the inclusion and exclusion of particular forms of expertise.

Investigating the internal dynamics of IPBES through the lens of boundary work is essential, as existing literature on science–policy boundaries mainly focuses on the IPCC and climate governance (e.g., Beck and Mahony 2018; Berkhout 2010; Hansson et al. 2021; Hoppe et al. 2013; Lidskog and Sundqvist 2015; Lövbrand 2007; Mahony 2013; Sundqvist et al. 2018; Sundqvist et al. 2015; Tuinstra 2008; Tuinstra et al. 2006). However, even in this climate context, empirically grounded reflections on boundary work are rare. This becomes even more pronounced regarding IPBES and the global governance of biodiversity. Despite a growing body of critical research investigating the uneven politics of knowledge, science–policy relations, and construction of expertise, only few studies focus explicitly on boundary work and its implications in IPBES (e.g., Arpin et al. 2016; Borie 2016; De Donà and Linke 2022; Gustafsson et al. 2019). We complement these findings by offering a fine-grained and in-depth empirical analysis of boundary work during the IPBES global assessment processes—arguably one of IPBES’ most prominent activities. This research is timely and relevant, as IPBES presents a relatively young organization that has only just completed its first work program and exhibits a certain willingness to learn and overcome limitations of the IPCC.

Our contribution to the literature is twofold. First, we address experts, political representatives, stakeholders, and administrative staff responsible for shaping IPBES work programs, rules of procedures, and institutional settings to promote a reconceptualization of science–policy relations beyond the linear model of expertise. Our findings are also relevant outside this IPBES community. As one of the most progressive global boundary organizations that is growing in importance, IPBES contributes “to the shaping of science–policy relations in the environmental domain” (Gustafsson et al. 2020, p. 9). By analyzing the internal dynamics of IPBES, we hope to inform actors responsible for designing other boundary organizations on global, national, or local levels. Actors involved in these processes need to understand the mechanisms that configure science–policy relations and their governance implications. Hence, they need to engage in critical discussions about boundary work.

Second, we aim to make a theoretical contribution by linking insights from STS and Political Ecology with our empirical findings of how boundary work is performed in practice. Hereby, we seek to add analytical depth to the concept of boundary organization beyond its current use as

descriptive “empirical label” (Gustafsson and Lidskog 2018, p. 1) that black-boxes science–policy relations. We illustrate that the lens of boundary work promotes a processual view of organizational design as open-ended making and remaking (Langley et al. 2019). This perspective accounts for the ongoing configuration of science–policy relations and the inclusion and exclusion of different forms of expertise when studying boundary organizations. An in-depth understanding of boundary work helps boundary organizations move beyond the linear model of expertise and fulfill their transformative potential by developing more effective sustainability solutions.

In the following, we first outline the concept of boundary work that is used to study the IPBES global assessment process. Second, we provide an overview of IPBES and its global assessment process and introduce our methodology. In the next sections, we present how boundary work was performed during the IPBES global assessment process and discuss major effects of this boundary work for the production of biodiversity knowledge. The paper closes with a summary and reflection of our findings.

## Boundary work and the science–policy interface in global environmental assessments

### Boundary work

The notion of ‘boundary work’ was originally introduced by Thomas F. Gieryn (1983, 1999) to describe the (strategic) demarcation of science from non-science. In STS research, boundary work has presented a useful lens to analyze the processes through which the science–policy interface is continuously maintained, shifted, stabilized, or destabilized in global boundary organizations and environmental governance (e.g., Beck and Mahony 2018; De Donà and Linke 2022; Gustafsson et al. 2019; Hansson et al. 2021; Sundqvist et al. 2015, 2018; Tellmann and Gulbrandsen, 2022; Tuinstra et al. 2006).

By conceptualizing boundary work as an ongoing process, boundaries, such as science–policy interfaces, are no longer understood as static lines or fixed markers of difference. Instead, they are perceived as contingent, permeable, and flexible membranes (Newman 2006; Paasi 1998). Through the lens of boundary work, what counts as ‘science’ or ‘policy’ varies between different contexts and points in time (Beck and Mahony 2018; Tuinstra 2008). The science–policy interface is, therefore, an outcome of social and political processes.

Studies on boundary organizations have shown that boundary work is performed through different mechanisms and practices. In boundary organizations these may

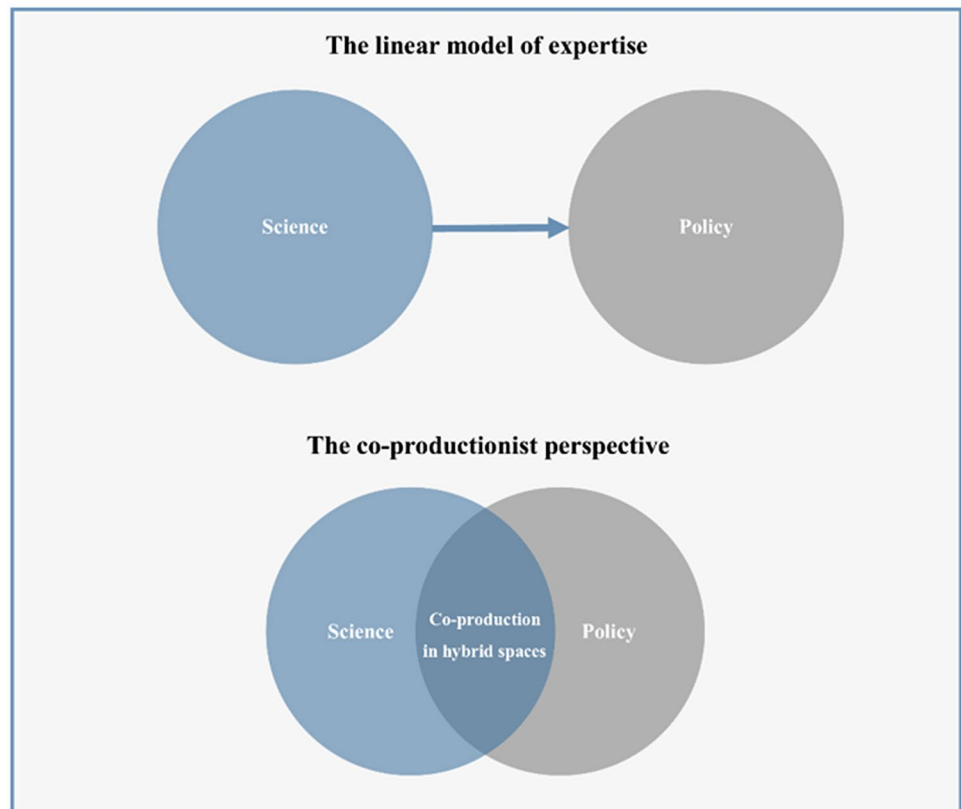
include rules of membership, criteria for defining evidence, and review procedures. These mechanisms and organizational design choices seek to stabilize the science–policy interface by defining clear responsibilities for each domain (Beck et al. 2017). However, boundary work is also full of paradoxes. The contributions of Halffman (2003), Tuinstra et al. (2006), Sundqvist et al. (2015, 2018), and Hoppe et al. (2013) demonstrate that boundary work has two presumably contradictory dimensions. First, science and policy domains are separated, or purified (c.f. Latour 1993), into distinct units by drawing clear boundaries between them. This ‘demarcation’ attempts to prescribe proper ways of behavior for participants on either side of the boundary. Second, the ‘integration’ (or ‘coordination’) of science and policy defines how the two relate to each other through mutual exchange (see Halffman 2003; Sundqvist et al. 2015; Tuinstra et al. 2006). Despite this apparent contrast, demarcation and integration are interrelated processes that present “two sides of the same coin” (Hoppe et al. 2013, p. 284). Both processes are closely related and the concurrent practices of demarcation and integration/coordination together form boundary arrangements (Hoppe 2005).

Hence, global boundary organizations, like IPBES, are best analyzed as hybrid spaces characterized by the strategic demarcation and mixing of science and policy domains (Miller 2001). Conceptualizing boundary organizations as hybrid spaces recognizes that science and policy are closely interlinked, mutually constitutive, and, therefore, co-produced. Moving beyond the linear model of expertise, the idiom of co-production implies that boundary work assigns places for science and policy and that science can never unconditionally speak truth to power (Jasanoff 2004a) (Fig. 1). (Scientific) knowledge production is, therefore, understood as situated practice that is embedded in socio-cultural and political contexts.

The way science–policy relations are negotiated through boundary work also determines what counts as credible, legitimate, and relevant expertise within specific contexts (Jasanoff 1990). Hence, boundary work has important effects for the production of environmental knowledge, the design and content of scientific assessments, and their impact on environmental decision-making (Beck and Mahony 2018). The study of boundary work has, thus, gained increasing attention in Political Ecology by providing “fundamental insights into the dynamic processes by which expertise becomes authoritative” (Beck et al. 2017, p. 1068), unchallenged, or more valued than other forms of knowledge.

Analyzing boundary work reveals that environmental knowledge production is shaped by uneven power dynamics through which particular environmental representations gain epistemic authority (Beck and Mahony 2018; Gustafsson et al. 2019; Lidskog et al. 2022). Such dominant representations are partial and selective, as they sideline

**Fig. 1** Schematic illustration comparing the linear model of expertise with a co-productionist perspective on science–policy relations



other actors, different knowledge systems, and alternative environmental explanations (Hajer 1995; Wiegleb and Bruns 2018). Consequently, boundary work presents a highly political, contextual, and contested process that is also performative by contributing to the constitution of natural and social orders (Beck and Mahony 2018; Hoppe et al. 2013; Jasanoff 1990).

In practice, science often ends up in a primary position to define environmental problems and their corresponding solutions (Hajer 1995; Turnhout 2018). While such knowledge and power relations are often concealed in boundary organizations that conform to the linear model of expertise, a co-productionist perspective on science–policy relations enables us to see “[w]ho is empowered through knowledge, and to what ends” (Jasanoff 2004b, p. 33). Conceptualizing boundary organizations as political spaces in which science and policy are co-produced through boundary work, therefore, helps to treat diverse forms of knowledge and environmental representations in more balanced ways. Such a critical and reflexive co-productionist approach from an STS perspective enables the establishment of power-sensitive and pluralist boundary organizations that are more inclusive for different knowledge holders (c.f. Beck and Forsyth 2020; Lövbrand et al. 2015; Miller and Wyborn 2020; van Kerkhoff and Pilbeam 2017; Wyborn et al. 2019). Marginalized environmental perspectives move closer to the center of

attention, which results in a wider range of environmental explanations, policy options, and solutions.

### **IPBES and its global assessment on biodiversity and ecosystem services**

In 2012, IPBES was founded by 94 governments as independent intergovernmental body with the principle aim to “strengthen the science–policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development” (IPBES 2012, p. 1). To this end, the current 2030 work program pursues six objectives: (1) assessing the state of knowledge on biodiversity and nature’s contributions to people, (2) building capacities of individuals and institutions for a strengthened science–policy interface, (3) strengthening the knowledge foundations for the work of IPBES by promoting the generation of knowledge and management of data, (4) supporting policy by identifying and promoting the development and use of policy instruments, support tools, and methodologies, (5) communicating and engaging with members and stakeholders to increase the visibility of IPBES and use of its products, and (6) improving the effectiveness of IPBES through regular internal and external review (IPBES, n.d.-c). Among these objectives, assessing the state of biodiversity and ecosystem services

is particularly important and the first IPBES Global Assessment on Biodiversity and Ecosystem Services (IPBES 2019a) presents a highlight of the first work program (2014–2018).

The establishment of IPBES took a long time and builds on experiences of the Intergovernmental Panel on Climate Change (IPCC) (Loreau et al. 2006; Watson 2005). Similar to the organizational structure of the IPCC, United Nations (UN) member States are eligible for IPBES Plenary membership. The Plenary acts as IPBES' main governing body, as it provides the organization's funding and takes decisions about work programs, rules of procedures, and approval of assessment reports. At the time of writing, 139 governments are represented in the IPBES Plenary.

To implement the platform's goals and administrative functions, a small IPBES Secretariat was established in Bonn, Germany, which is hosted under the auspices of the United Nations Environment Programme (UNEP). The IPBES Secretariat also supports the Plenary's two subsidiary bodies: the Multidisciplinary Expert Panel (MEP) and the Bureau. The MEP comprises (scientific) experts from each of the five UN regions and is mainly responsible for providing advice on scientific and technical matters. The Bureau is in charge of administrative functions and (like the MEP) is also representative of the UN regions, with two members for each region. Additional contributors to and end users of IPBES' products are grouped under the categories 'observers' and other 'stakeholders' (IPBES, n.d.-b).

While IPBES is sometimes referred to as the "IPCC for biodiversity" (Borie et al. 2020, p. 71), it also seeks to overcome shortcomings of the climate panel, which has been criticized for its narrow (Western) scientific framing of climate change (Demeritt 2001; Miller 2004). To address these limitations, IPBES aims to provide more holistic and inclusive environmental assessments by enabling gender equality, as well as interdisciplinary, multidisciplinary, and regionally balanced knowledge production (IPBES 2012). IPBES has committed itself to facilitating the participation of non-scientific actors and incorporating indigenous and local forms of knowledge (ILK) into all of its activities (IPBES 2012).

This "attempt to 'do different'" (Borie et al. 2020, p. 71) serves us as an invitation to examine the practices of knowledge production at the science–policy interface for biodiversity and ecosystem services. Indeed, despite holistic and inclusive ambitions, knowledge production in IPBES poses several challenges. Studies on representation expose geographical, gender, and disciplinary imbalances in IPBES expert teams and organizational bodies (e.g., Báldi and Palotás 2021; Heubach and Lambini 2018; Kovács and Pataki 2016; Montana and Borie 2016; Stenseke 2016; Timpte et al. 2018). By reviewing the integration of different stakeholders and various forms of expertise, several articles discuss epistemological and ontological challenges, as well as

knowledge hierarchies embedded in IPBES processes and institutional design choices (e.g., Borie and Hulme 2015; Borie et al. 2021; Díaz-Reviriego et al. 2019; Esguerra et al. 2017; Esguerra and van der Hel 2021; Gustafsson et al. 2019; Löfmarck and Lidskog 2017; McElwee et al. 2020; Morin et al. 2017; Obermeister 2017; Oubenal et al. 2017). Additional studies illustrate how uneven knowledge–power relations may promote a dominant market-oriented and utilitarian understanding of biodiversity in IPBES (e.g., Kenter 2018; Muradian and Gómez-Baggethun 2021; Thorén and Stålhammar 2018; Turnhout et al. 2013, 2014). Previous research has also investigated science–policy relations, the construction of expertise, and related challenges in IPBES (e.g., Gustafsson 2018; Gustafsson et al. 2020; Koetz et al. 2012; Pasgaard et al. 2017; Turnhout et al. 2016). To overcome these challenges and to better integrate different forms of expertise in IPBES, more power-sensitive approaches have been proposed (e.g., Montana 2019; Neßhöver et al. 2016; Tengö et al. 2017).

Despite this growing body of critical literature, only few studies focus explicitly on boundary work and its implications in IPBES (e.g., Arpin et al. 2016; Borie 2016; De Donà and Linke 2022; Gustafsson et al. 2019). Arpin et al. (2016) draw on the lens of institutional entrepreneurship to highlight how individual actors performed boundary work during the institutionalization of IPBES. Borie (2016) investigates boundary work during the constitution of the Multidisciplinary Expert Panel (MEP). Gustafsson et al. (2019) analyze boundary work between senior and junior experts, between science and policy, and between scientific knowledge and indigenous and local knowledge in the context of the IPBES fellowship program. Most recently, De Donà and Linke (2022) conducted a literature and document analysis to compare science–policy boundaries in IPBES with other advisory organizations. In this paper, we contribute to and complement these findings by first offering a fine-grained and in-depth empirical analysis of boundary work during the IPBES global assessment processes. Our second objective is to investigate the effects of this boundary work on the production of biodiversity knowledge in IPBES. The global assessment serves us as an illustrative example of how science–policy relations and knowledge production are organized in the IPBES assessment processes and wider organization. For a better understanding, we provide a short overview of the global assessment that followed predefined phases also valid for other IPBES assessments (Fig. 2).

The global assessment process ran for three years (Feb, 2016–May, 2019), during which a core team of 145 expert authors (including co-chairs, coordinating lead authors, lead authors, review editors, and fellows), with inputs from an additional 310 contributing authors, compiled the final report (IPBES, 2019b). These experts were to critically assess "the state of knowledge on recent past (from

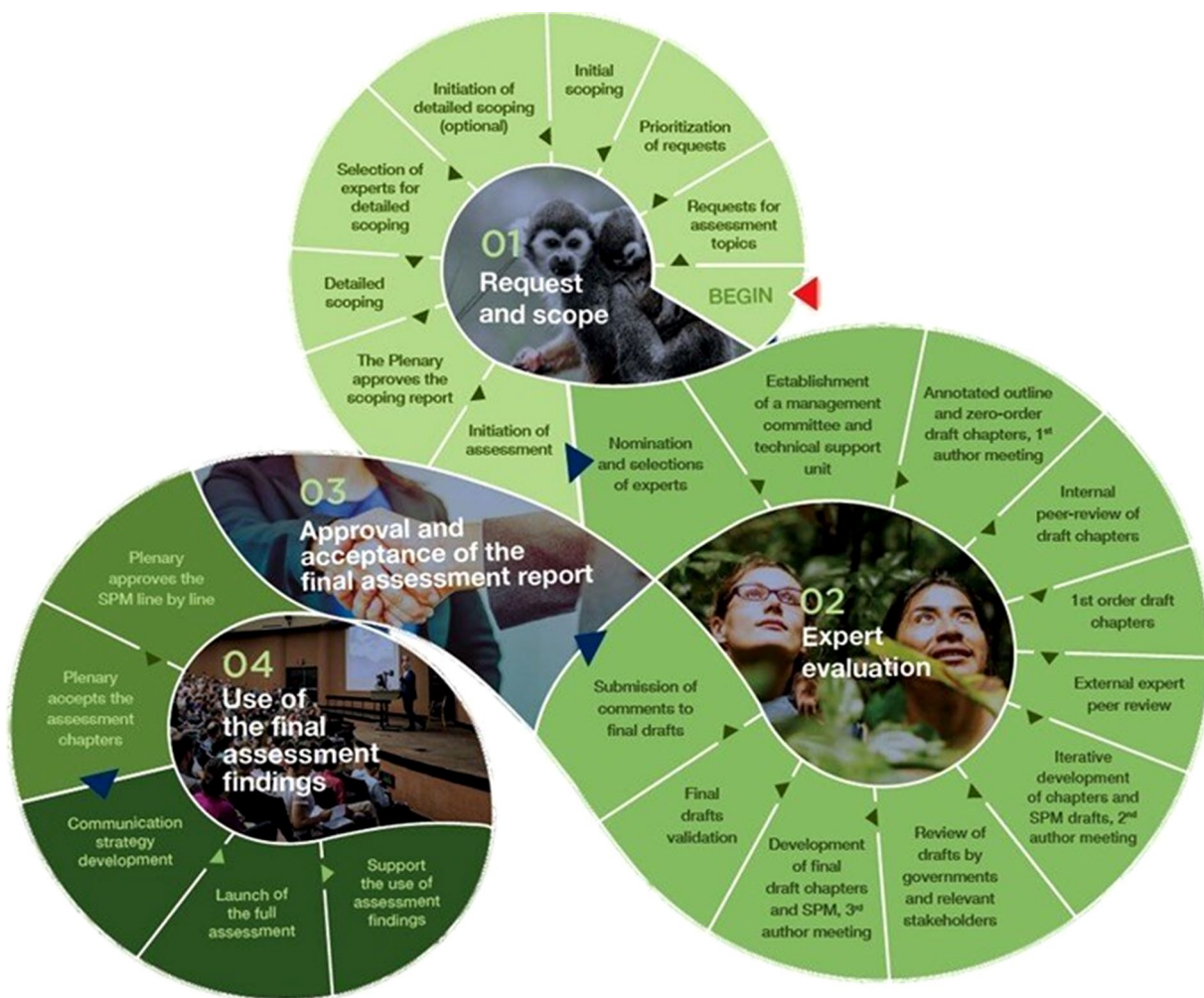


Fig. 2 The IPBES assessment process (IPBES 2018, p. 8)

the 1970s), present and possible future trends in multi-scale interactions between people and nature” (Brondízio et al. 2019, p. 6).

The final decision to perform a global assessment on biodiversity and ecosystem services was taken during the 4th IPBES Plenary meeting in 2016 (IPBES 2016a). Previously, a small scoping team, overseen by the MEP and Bureau, outlined questions and topics to be addressed in the assessment based on requests by IPBES member States (c.f. IPBES 2018). Once this scoping report and outline of the global assessment was approved by the Plenary, IPBES member States and observer organizations were called upon to nominate potential experts. Following this nomination, MEP members selected the expert teams consisting of co-chairs, coordinating lead authors, lead authors, review editors, and fellows. Although most of the experts had an academic background, IPBES also sought to include non-academic actors in the global assessment. The final team of experts had to provide the chapter contents in line with the

scoping requirements and the IPBES conceptual framework. Most of these experts worked on a voluntary basis and were responsible for assessing the state of biodiversity and ecosystem services through literature reviews, as IPBES does not conduct research of its own.

During the initial writing phase, the selected experts prepared a preliminary version of the assessment report. More advanced drafts (i.e., first- and second-order drafts) were then reviewed by external experts and government representatives. In line with this feedback, the authors prepared a final version and a Summary for Policymakers (SPM) (c.f. IPBES 2018). Lastly, and by negotiating the SPM line-by-line, government representatives adopted the final draft of the SPM and overall report during the 7th IPBES Plenary in 2019.

The IPBES global assessment report presents an important milestone in establishing biodiversity on the global political agenda. By concluding that 1 million species are threatened with extinction and by calling for transformative

change (IPBES 2019b), the global assessment attracted considerable international publicity and media attention.

## Methods

This article employs a qualitative research approach. Empirical data collection was carried out through 23 semi-structured interviews conducted between June 2019 and February 2020 with IPBES experts ( $n=14$ ), administrators ( $n=7$ ), and government representatives (i.e., actors participating in member state delegations during the 7th Plenary) ( $n=2$ ). Following Montana (2017), we define IPBES experts as authors selected for the IPBES global assessment (anonymized as E1–E14), while administrators were defined as those working in the IPBES Secretariat, Technical Support Unit, Bureau, and MEP (anonymized as A1–A7). Participants of government delegations were anonymized as N1 and N2. Interview partners were selected on the basis of their direct involvement in the global assessment process, which implies the participation throughout (or insights into) the particular assessment phases analyzed in this paper: (1) the nomination and selection of experts ( $n=6$ ), (2) the drafting of the assessment text ( $n=14$ ), and (3) the Plenary negotiations ( $n=13$ ). These phases are intended as illustrative cases and do not claim to be exhaustive. As only two representatives of government delegations were interviewed, insights into the Plenary negotiations were primarily derived from IPBES experts providing a scientific perspective. Experts were also chosen to represent different chapters of the report. Unfortunately, to ensure the anonymity of our interviewees, we cannot provide further details about their disciplinary backgrounds, gender, nationalities, or particular roles in IPBES.

Interviews were conducted via Skype or telephone with conversations lasting between 30 and 90 min. Most interviews were conducted in English and four in German. An openly designed guideline presented the basis for the interviews and comprised specific topics: (1) sequence of events and personal experience of the global assessment process, (2) responsibilities and roles of different actors and organizational bodies, (3) the relation between science and policy, (4) criteria for defining expertise in IPBES and different ways of including various stakeholders and forms of knowledge in the assessment process, (5) reflections about interviewees' own roles as participants at the science–policy interface. These subjects and related challenges were discussed in the context of the global assessment process. All interviews were audio-recorded, digitally transcribed, and encoded using the software ATLAS.ti. We used a combination of inductive (e.g., nomination/selection process) and theoretically informed codes (e.g., integration vs. demarcation of science–policy) to analyze the interview material. The empirical data collection was complemented by an extensive

review of scientific literature on IPBES and official documents available online.

## Boundary work during the IPBES global assessment process

In this section, we draw on our empirical findings to illustrate how mechanisms of boundary work assigned places for science and policy during particular phases of the IPBES global assessment process: (1) the nomination and selection of experts, (2) the drafting of the assessment text, and (3) the Plenary negotiations.

### The demarcation and integration of science and policy

Our results indicate that the global assessment process fluctuated between efforts to both demarcate and integrate science and policy domains. These instances were closely interrelated and also occurred simultaneously.

### The nomination and selection of experts

Before drafting the global assessment report, IPBES experts (in this case authors of the assessment) had to be nominated and selected. Great efforts were made to separate scientific from political activities to safeguard the independence and objectivity of the selection process. The selection of experts was led by the Multidisciplinary Expert Panel (MEP), which is required to work independently of IPBES member States to secure the “*scientific credibility*” (A3) and “*scientific quality*” (A5) of IPBES' products—in this case, the global assessment report. Although appointed by the Plenary, “*MEP members are elected in their own capacities*” (A6). This means that members of the MEP do not represent their national governments or UN regions. Instead, the MEP is referred to as an independent scientific body “*representing science*” (A4) and the “*academic community*” (A2). Hence, putting the MEP in charge of the selection process aimed at maintaining a stable and clear-cut science–policy interface.

While the selection of experts was to take place in an independent manner guided by impartial scientists and standardized criteria, government representatives were still indirectly involved in the selection process. Notably, member States nominated potential experts. This was highly relevant for the composition of author teams, as experts could only be selected “*when they [were] in the pool*” (A1) of nominations. Nominations followed the ‘80/20 rule’ with 80% of experts being nominated by governments and 20% by other observer organization such as universities or non-governmental organizations. Hence, science and policy were closely interrelated as “*there [was] lots of involvement of*

governments” (E6) to “regulate the configuration of the teams” (E3).

### Drafting the assessment text

Similar patterns of both demarcation and integration emerged during the drafting phase of the assessment. Science and policy domains were carefully separated with the intention to keep authors apart from political influences, while compiling the first version of the report: “*Because these expert groups should work completely independently, without influence, without being biased, without getting into a conflict of interest*” (N1). To further safeguard this independence, IPBES member States were not allowed to steer the content of the assessment during this drafting phase: “*It is an independent process that cannot be controlled by governments or anyone else. It’s entirely in the hands of the experts*” (N1). Interviewees also claimed that IPBES experts were committed to science and did not “*represent the interests*” (N1) of national governments that had originally nominated them.

These demarcation efforts aimed at securing the scientific integrity of experts and credibility of the final assessment text. However, science and policy realms were also closely connected during this particular assessment phase, as draft versions of the report and SPM were distributed to member States for review. Government representatives provided feedback and comments on the content of the report: “[*S*]till in the process of writing the report we have two times external reviews. So, at that time, governments can get involved to make some comments” (E5).

### The Plenary negotiations

The 7th IPBES Plenary (May 2019) presents one of the most obvious convergences of scientific and policy realms. During this Plenary, governments not only adopted the final assessment report but also actively negotiated the SPM “*line by line*” (A3) and word for word.

Despite this rather apparent effort to integrate science and policy domains, the Plenary negotiations were also characterized by attempts to maintain and reinforce a stable science–policy interface. IPBES experts (in this case coordinating lead authors and co-chairs of the assessment) attended the SPM negotiations to maintain the quality and “*good level of science*” (A2). These experts were to provide answers to questions posed by IPBES member States. They also had to decide whether proposed alterations were supported by scientific evidence: “*When they [government representatives] proposed: Can we change the wording to this? The chair then looked to you, whatever time in the morning it is, and you had ten seconds to say, or less, yes that’s okay or no, that’s not consistent with the science*” (E9).

## Boundary work through formalized structures and informal judgement

During the IPBES global assessment process, various mechanisms facilitated the demarcation and integration of science and policy domains. First, demarcation and integration occurred via formalized boundary work embedded in institutional design choices and official rules of procedure. Second, boundary work was also performed in a more spontaneous manner through informal judgement passed by individuals or groups of people involved in the global assessment process.

### Formalized structures

Analyzing the three assessment phases outlined above through the lens of boundary work reveals that science–policy relations were primarily organized through institutional design choices. Hence, these mechanisms of boundary work also apply during other assessment processes and IPBES activities.

In IPBES, science and policy are separated into distinct organizational bodies in order to stabilize the science–policy boundary. Notably, the MEP is “*representing science*” (A4) and provides advice on all scientific and technical matters in IPBES. Contrary to the MEP, IPBES member States are represented in the Plenary, which serves as the domain of government representatives from various ministries (e.g., ministry of the environment or ministry of foreign affairs).

Apart from these efforts to separate science and policy into distinct organizational units, IPBES governance structures also facilitate the integration of science and policy domains. The Bureau, for instance, is formally intended as hybrid body in charge of administrative and political functions in IPBES. Members of the Bureau are often professional academics “*responsible for the political original interests*” (A3) of IPBES’ member States.

In the context of the global assessment process, boundary work was also performed through formalized rules of procedure. These procedures regulated the nomination and selection of experts and determined who would count as authoritative expert for biodiversity and ecosystem services. According to these guidelines, potential experts should exhibit: (1) scientific expertise in biodiversity and ecosystem services with regard to both natural and social sciences and traditional and local knowledge, (2) scientific, technical, or policy expertise, and knowledge of the main elements of IPBES’ work programs, (3) experience in communicating, promoting, and incorporating science into policy development processes, and (4) ability to work in international scientific and policy processes (IPBES 2014, p. 13). The selection of experts was guided by additional criteria including geographical representation, gender balance, diversity of knowledge systems, and disciplinary diversity (IPBES



2015). The number of scientific publications, professional experience, and the overall resume of each potential candidate were also important.

Following the selection of experts, the drafting phase of the assessment was largely steered by rules of procedure aimed at maintaining a stable science–policy interface by formulating clear responsibilities for both experts and government representatives. For example, authors were provided with official regulations, quality criteria, and standards defining how to review existing literature and knowledge on biodiversity: “*Everything is, you know, formalized. How these reviews have to be done, the kind of quality of the information*” (E13). This is further confirmed by one particular interview excerpt: “*There were some suggestions that you should use reliable science databases and perhaps Scopus and google scholar as well. And you shouldn't focus on grey literature*” (E8). Through these regulations, IPBES determined what should count as reliable and relevant knowledge claims. In combination, these measures aimed at ensuring that “the Platform’s products are comprehensive and objective and remain neutral with respect to policy” (IPBES 2015, p. 20).

However, IPBES’ rules of procedure also facilitated the integration of science and policy domains. For instance, as part of a standardized process, draft versions of the report and the SPM were distributed to member States for review: “*And it's all done in a very formal way, so every comment that's submitted, which we then got four months later in a massive spread sheet... we had to go through, write responses to every comment and adjust the text as appropriate*” (E9). The preparation of the final draft of the report should then reflect comments made by governments and other experts.

### Informal judgement

Apart from such formalized procedures, boundary work can also occur in a much more individualized and less institutionalized manner (Waterton 2005). This became obvious during the global assessment process, where boundary work was also conducted spontaneously through informal judgement passed by individuals or groups of people. This individualization of boundary work (c.f. Gustafsson et al. 2019) implies that science–policy relations could be configured differently with different outcomes in other IPBES assessments.

While the selection of experts was regulated through official criteria, informal negotiations among members of the MEP determined the final composition of author teams: “*So, it is a process of discussion, discussion and trying to find the best possible person*” (A5). These discussions were challenging, as they were occasionally shaped by contestation and disagreement: “*[S]ometimes we don't agree. So how do*

*you manage, you know? It doesn't happen very often [...] but there were at least two cases where I was in disagreement and I didn't win*” (A4). Hence, who should count as relevant expert for the IPBES global assessment process was influenced by boundary work performed through informal negotiations and individual decisions.

The same applies for the drafting phase of the assessment text. To prevent personal bias influencing the content of the report, official rules of procedure sought to regulate the review and summary of biodiversity knowledge. However, this approach neglects that scientific knowledge production also presents an open and creative process: “*There are some conventions but at the end of the day, science is a creative field. You cannot be too rigid because if you are too rigid, you lose creativity, you lose spontaneity*” (E13). While IPBES sought to maintain a stable science–policy interface by standardizing methods for reviewing existing literature, interviewees acknowledged that science cannot be totally free from judgement: “*And in the end it's still judgement, it's very hard to get away from*” (E4). By deciding on how to frame particular topics and what sources to draw on, authors of the report ultimately determined what should count as relevant and credible knowledge claims. Individual experts dealt with these inherent tensions in their own ways, as stated by one interviewee: “*I tried to be as objective as I could within my own subjectivity*” (E8). Through these informal and spontaneous judgements, IPBES experts actively performed boundary work.

Of all three assessment phases, the Plenary negotiations present another prominent example of informal boundary work. During the Plenary, IPBES experts had to decide whether government requests to change parts of the SPM were in line with “*the good science*” (A2). In these particular instances, what should count as science and reliable knowledge was decided spontaneously by individual scientists, as illustrated through this quote: “*15,000 references were reviewed for the whole assessment. So, you better remember what source that sentence was based upon and what that source said, whether it was the mean or the median. A lot of them [government representatives] wanted to change the wording like: Can we change this to something else? And you have got to work out, is that appropriate given the material that went in?*” (E9).

Our results indicate that the way boundary work was performed during the IPBES global assessment process is not coincidental. As argued by Tim Forsyth: “[t]he decision to place boundaries in particular forms around different problems, or in favor of particular groups [...] facilitates the achievement of political objectives of those who draw the boundaries” (Forsyth 2004, p. 90). In the context of the global assessment report, science and policy domains were continuously demarcated to ensure that “the Platform’s products are comprehensive and objective and remain neutral

with respect to policy” (IPBES 2015, p. 20). By seeking to prevent potential bias, personal judgement, and special interests from influencing the content of the report, IPBES sought to safeguard the scientific credibility of the final assessment.

Simultaneously, science and policy domains were integrated to increase the relevance and legitimacy of the IPBES global assessment. From the earliest stages of the assessment process, government representatives were involved in the production of biodiversity knowledge. As Sundqvist et al. (2015) illustrate for the case of the IPCC reports, “[t]he motivation for this arrangement is to increase policy-makers’ ownership of the reports and to secure relevance and legitimacy, as well as to establish a common scientific ground for the international climate negotiations” (ibid., p. 425). Fostering relevance and legitimacy is very important for IPBES, as it seeks to establish itself as authority for the global governance of biodiversity: *“If governments do not feel represented or heard then they will not participate, they will not support the organization. So, I think that search for legitimacy is part of its mandate”* (E13).

Our analysis shows that IPBES assumes a stable and pre-defined science-policy interface. This is supported by claims that the final assessment report provides politically neutral and “authoritative science [...] to decision-makers for their consideration” (IPBES 2019b). By conforming to the ideals of scientific objectivity and political neutrality, IPBES reproduces the linear model of expertise (e.g., Borie 2016; De Donà and Linke 2022; Gustafsson et al. 2019; Koetz et al. 2012; Lahsen and Turnhout 2021; Raina and Dey 2020; Turnhout et al. 2014; Turnhout and Purvis 2020).

However, investigating the global assessment process through the lens of boundary work shows that science–policy relations in IPBES are not fixed but continuously maintained, shifted, and negotiated. As science and policy domains are closely interlinked and mutually constitutive in IPBES, we argue that they are, in fact, co-produced. This co-productionist perspective implies that boundary work assigns places for science and policy and that science can never unconditionally speak truth to power (Jasanoff 2004a). Instead of conforming to the linear model of expertise, we argue that organizations, such as IPBES, would benefit from adopting a co-productionist lens that recognizes boundary organizations as highly political and hybrid spaces (Miller 2001).

## Unpacking hidden politics of biodiversity knowledge production

Apart from assigning places for science and policy in IPBES, mechanisms of boundary work also determined which environmental expertise would be considered valid and authoritative in the context of the assessment process.

In this section, we draw on our empirical findings presented in section “[Boundary work during the IPBES global assessment process](#)”, further insights from our interviews, and additional literature to discuss how boundary work facilitated the inclusion and exclusion of particular forms of expertise during the global assessment process. We argue that, first, boundary work continuously established modern biodiversity science as authoritative voice for addressing biodiversity loss. Second, spatial aspects of boundary work highlight the power differentials between IPBES member States that are manifested in uneven patterns of participation and geographies of (biodiversity) knowledge.

### Establishing the authority of science

As illustrated in section “[Boundary work during the IPBES global assessment process](#)”, selecting experts for the global assessment process marked an important step in defining what expertise would be included in the organization and its assessments. Who would be considered as credible, legitimate, and relevant expert for the global assessment process was regulated by official and seemingly objective selection criteria. This choice of experts, however, was not neutral, as selection criteria favored high-rank academics: *“[I]t's scientists selecting scientists. All selection processes are totally biased towards the selection of scientists. I mean it doesn't just have to be scientists but scientists with good reputation and, you know, good performance”* (E13). This is further supported by Gustafsson et al. (2019) who argue that processes of boundary work in IPBES “have excluded actors with backgrounds other than scientific ones” (ibid., p. 187).

This observation seems to contrast with IPBES’ commitment to include different stakeholders and accord greater value to indigenous and local forms of knowledge (ILK). To overcome peer-reviewed science as “gold standard” (Beck et al. 2014a, p. 84) and to safeguard the engagement with ILK, IPBES established several procedures and instruments (see Hill et al. 2020 for full overview). These include, for instance, an ILK taskforce “for strengthening the quality of indigenous peoples’ participation in the platform’s deliverables” (Beck et al. 2014a, p. 84). During the assessment process, dialogue workshops encouraged the participation of indigenous and local communities. Additionally, IPBES welcomed ILK-holders, ILK-experts, and experts on ILK as authors or reviewers of the assessment (Hill et al. 2020; IPBES, 2017).

Compared to previous environmental assessments (e.g., the IPCC), ILK systems have, thus, gained a more prominent status in IPBES. However, “[p]ower asymmetries remain a formidable barrier to working across knowledge systems in IPBES and other environmental assessments” (Hill et al. 2020, p. 17). As demonstrated in section “[Boundary work during the IPBES global assessment process](#)”, this is

exemplified by selection criteria favoring high-rank academics as authors of the assessment and criteria for the literature reviews privileging scientific knowledge: “Because we are asked to do a systematic literature review and you use an engine such as Scopus or something, they are very biased towards a particular type of literature” (E3). Databases like Scopus comprise scientific publications but often disregard gray literature and other forms of expertise or documentation. Even the fact that the assessment presents a written report neglects other forms of expertise, as indigenous knowledge is often transmitted orally. Hence, despite IPBES’ integrative ambitions, great efforts to include ILK knowledge, and official claims that “[e]verybody is relevant for the task” (A4), scientific dominance was continuously established in the context of the global assessment report.

By failing to address these uneven knowledge–power relations, IPBES risks reproducing traditional modes of knowledge production that cast scientists as “holders of knowledge and other stakeholders as holders of values or perspectives to be corrected by science” (Turnhout et al. 2020, p. 17). Reinforcing this hegemony of global biodiversity science through mechanisms of boundary work may have important consequences for the content of IPBES assessments and global governance of biodiversity, as scientific practice promotes the emergence of dominant but selective environmental explanations (e.g., Forsyth 2004; Jasanoff and Martello 2004; Miller 2004; Turnhout 2018). We argue that IPBES’ ambition to promote the equitable inclusion of non-scientific and scientific expertise in its assessments is counteracted by its linear approach to science–policy relations, which seeks to preserve scientific authority.

### The uneven geographies of (biodiversity) knowledge production

Apart from establishing modern biodiversity science as authoritative expertise for addressing biodiversity loss, boundary work also had an important geographical component, as power differentials between IPBES member States manifested in uneven patterns of participation and the spatial representation of (biodiversity) knowledge.

This became particularly obvious during the nomination and selection process, which determined what expertise would be included in the assessment. As shown in section “Boundary work during the IPBES global assessment process”, IPBES member States nominated the majority of potential experts for the global assessment process, which harbors the risks of governments trying to safeguard their influence over the production of biodiversity knowledge by controlling who will count as an expert (Beck et al. 2014a). As stated by one interviewee: “It becomes political very quickly, because experts are nominated by countries” (E14). Indeed, the nomination and selection of experts reflected

uneven power relations among IPBES member States: “There are regions that don’t nominate many people” (A3). Applications from “Africa, Eastern European countries, and maybe Asia” (A5) were lacking, while the majority of experts were nominated on behalf of the United States (US), Australia, and Western Europe.

As argued by Beck and Mahony (2018) for the case of the IPCC, such imbalances entail the risk of giving scientifically dominant countries undue influence over the terms of knowledge production and policy debates. Although IPBES actively seeks to overcome these disparities, structurally limiting factors, such as language, continuously reinforce uneven patterns of participation and representation: “Geographical representation is more difficult to achieve [...] first of all because of language. If you are speaking Chinese and you don’t have publications in English, it is difficult. If you are West-African and you speak French... that’s not the language of the assessments” (A4). By focusing on publications in English, the official language of the assessment, discourses taking place in other languages and world regions risk being excluded (Lynch et al. 2021). These geographical imbalances among IPBES experts ultimately manifested in uneven geographies of (biodiversity) knowledge: “[B]ecause you have an underrepresentation of certain regions there is going to be an underrepresentation of certain topics, too” (A4). As Beck and Mahony (2018) illustrated for the case of the IPCC and climate governance, this spatial dimension of boundary work risks marginalizing expertise from certain regions and places.

Apart from these spatial configurations of author teams, the IPBES Plenary negotiations were also highly political and characterized by international power dynamics. As shown in section “Boundary work during the IPBES global assessment process”, the IPBES Plenary provided an important platform for member States to guide the content of the report and engage in international diplomacy. In line with others (e.g., Vadrot, 2020), we argue that governments may utilize such intergovernmental settings to further their national interests, while discussing seemingly policy-neutral knowledge claims on the state of biodiversity and ecosystem services. Indeed, the SPM negotiations “really started to reflect the position of different countries” (E2). For instance, “China went through any mention of China anywhere in any of the chapters. They were looking at maps, anything that displayed Taiwan differently or whatever, they had comments on” (E9). Additionally, “South Africa didn’t like anything that talked about exploitation. The USA picked up on anything to do with gender they didn’t like” (E9). Hence, our findings support Beck et al. (2014b) who argue that “the prevailing intergovernmental negotiations inside the IPBES can be seen to act [...] as a cover for the existing political structures” (ibid., p. 13).

Investigating the actual effects of these geographical imbalances on the content of the global assessment report goes beyond the scope of this paper. However, research on the IPCC has shown that uneven geographies of knowledge and the dominance of Western science naturalized the framing of climate change as technocratic and globalized issue (Demeritt 2001; Miller 2004). Similar consolidations of “Western science-based” (Díaz-Reviriego et al. 2019, p. 460) biases in IPBES risk thwarting ambitions of promoting more regionally balanced and inclusive environmental knowledge production.

Overall, our analysis of the global assessment process demonstrates that seemingly objective knowledge claims about the global state of biodiversity mask the specific social and political circumstances in which this knowledge was produced (c.f. Forsyth 2004). By establishing modern biodiversity science as authoritative voice for addressing biodiversity loss and by reinforcing uneven geographies of knowledge, IPBES risks entrenching rather than problematizing dominant environmental explanations and solutions (c.f. Hansson et al. 2021). However, these “politico-epistemic struggles” (Borie et al. 2021, p. 1) and their implications are hidden from view, as IPBES conforms to the linear model of expertise and ideals of political neutrality and scientific objectivity. This linear model of expertise in IPBES represent a “lock-in” (Lahsen and Turnhout 2021, p. 5) that limits IPBES’ transformative potential and global action on biodiversity loss. To actively contribute to the transformative socio-environmental change it calls for, IPBES must fundamentally reconceptualize its understanding of science–policy relations and adjust the ways in which (biodiversity) knowledge is produced (c.f. Díaz-Reviriego et al. 2019; Gustafsson et al. 2019; Lahsen and Turnhout 2021). To this end, we argue that organizations like IPBES would benefit from adopting a critical and reflexive approach to co-production that enables us to see “[w]ho is empowered through knowledge, and to what ends” (Jasanoff 2004b, p. 33).

Arguably, IPBES already engages with the notion of co-production. While co-production is officially defined as the “joint contribution by nature and anthropogenic assets in generating nature’s contributions to people” (IBES, n.d.-a), co-production in IPBES also refers to the consultation between stakeholders and experts in IPBES (Beck and Forsyth 2020; IPBES, 2016b). This approach to knowledge co-production, however, is mainly “intended to make scientific findings interactive and ‘usable’” (Beck and Forsyth 2020, p. 220). Such a utilitarian and instrumental understanding of the concept differs greatly from the STS perspective described in section “[Boundary work and the science–policy interface in global environmental assessments](#)”. Adopting a more critical and reflexive co-productionist approach enables us to conceptualize boundary organizations as political

spaces in which science and policy are co-produced through boundary work. Such an approach facilitates the establishment of more power-sensitive boundary organizations by fostering greater transparency, self-reflection, and power-sharing between diverse knowledge holders in boundary organizations (e.g., Beck & Forsyth, 2020; Lahsen & Turnhout, 2021). Ultimately, a critical and reflexive approach to co-production renders boundary organizations more inclusive by paying greater attention to marginalized environmental perspectives.

To conclude, we suggest several practical steps to enact a critical and reflexive approach to co-production in IPBES and related boundary organizations:

1. Address mechanisms of boundary work that configure science–policy relations and facilitate the inclusion and exclusion of different forms of expertise. Science and policy need to be recognized as closely interrelated and mutually constitutive. This helps to forge a more nuanced and processual conceptualization of science–policy relations and boundary organizations beyond the ideals of political neutrality and scientific objectivity.
2. Recognize knowledge production as social practice embedded in specific social and political circumstances. Organizations like IPBES should establish self-reflexive practices for all actors involved to address positionalities, underlying assumptions, and hidden values embedded in the production of knowledge.
3. Acknowledge that environmental knowledge production at the science-policy interface presents a highly political and contested process shaped by uneven participation and power dynamics. Addressing uneven knowledge–power relations fosters transparency and engages more fundamentally with diverse worldviews and environmental realities. This could empower marginalized groups and promote more meaningful participation.
4. Engage with the “historical constraints” (Trisos et al. 2021, p. 1205) and lingering inequalities entrenched in the global scientific and political systems. Biases and power differentials between countries/ member States in global boundary organizations reinforce uneven geographies of knowledge that need to be addressed.

By implementing these suggestions, boundary organizations like IPBES could provide more pluralist environmental explanations and diverse policy options better suited to support transformative change towards more just and sustainable futures.

## Conclusion

By synthesizing environmental knowledge for policy-makers, global boundary organizations influence how we know and govern sustainability challenges. Therefore, it is essential to better understand what happens in and through these organizations before endorsing them as epistemic and political authorities in environmental governance. In this paper, we have examined the very practices that configure science–policy relations in global boundary organizations by studying the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES). We have illustrated that IPBES envisions a stable and predefined science–policy boundary, pursues the ideals of political neutrality and scientific objectivity, and conforms to the linear model of expertise. However, analyzing the IPBES global assessment process through the lens of boundary work demonstrates that science–policy relations are not fixed but constantly maintained, shifted, and negotiated. During the global assessment process, boundary work was achieved via formalized mechanisms embedded in organizational design choices and official rules of procedure. Boundary work also had a more spontaneous component, as the science–policy interface was continuously negotiated by individuals and groups of people involved in the assessment process. Together, these deliberate and incidental mechanisms assigned places for scientists and policy-makers within IPBES and hereby configured science–policy relations.

As science and policy domains in IPBES are closely interlinked and mutually constitutive, we argue that they are, in fact, co-produced. Instead of conforming to the linear model of expertise, organizations, such as IPBES, might benefit from adopting a co-productionist lens that recognizes boundary organizations as political and hybrid spaces. Such an approach would help to better understand science–policy relations and their effects in global boundary organizations and environmental governance.

This paper also identified two primary effects of boundary work on the production of biodiversity knowledge during the IPBES global assessment process. First, despite IPBES' aims to include non-scientific expertise (e.g., ILK or practitioners), boundary work continuously established modern biodiversity science as authoritative voice for addressing biodiversity loss. Second, spatial aspects of boundary work highlight the power differentials between IPBES member States that are manifested in uneven patterns of participation and geographies of (biodiversity) knowledge. We conclude that these uneven politics of knowledge are usually concealed through IPBES' linear approach to science–policy relations and norm of political neutrality. Adopting a critical and reflexive co-productionist approach could help IPBES

to live up to its integrative ambition by openly addressing imbalances in environmental knowledge production through more inclusive and transparent practices. Through this, boundary organizations, such as IPBES, could increase their legitimacy and provide more diversified environmental explanations, policy options, and transformative solutions.

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