29

The Planetary Boundaries

Knowing What the Question Is

SIMON P. MEISCH

29.1 Taking a Pinch of Salt, Yielding the Volume's Insights

Where do we stand now, at the end of this book on ethics and planetary boundaries? To approach this question, we will, as it were, take a proverbial pinch of salt and turn to Douglas Adams' *The Hitchhiker's Guide to the Galaxy*. It may seem surprising, but the work offers fitting inspiration for gathering the diverse insights of this volume's contributions on the complex relationships between ethics, science, and human environments.

In one of the novel's most famous scenes, the supercomputer *Deep Thought* announces 'forty-two' as the answer to the 'Ultimate Question of Life, the Universe, and Everything'. Its creators are left utterly perplexed. *Deep Thought*, unperturbed, gives them food for thought:

> 'I checked it very thoroughly,' said the computer, 'and that quite definitely is the answer. I think the problem, to be quite honest with you, is that you've never actually known what the question is.' (Adams 1992: 128)

It has long been recognized that how we frame a problem is both ethically and epistemologically sensitive. Not knowing what the real question is can easily result in enigmatic or even misleading answers – just like with *Deep Thought*. Moreover, the very framing of questions can (re)produce epistemic injustices and become morally problematic. This prompts us to ask: Does the planetary boundaries framework know 'what the question is' when it answers its own question of 'a safe operating space for humanity'? Or, as those who question the framework might put it, are boundary values simply other versions of 'forty-two'?

Depending on their stance, the authors in this volume assign different roles to ethical reflection. Those who assume that the planetary boundaries framework has understood its question correctly and offered fitting answers tend to focus on the ethical follow-up questions – the ethical implications of accepting (at least some of) the planetary boundaries framework's findings. Others challenge the

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framework's knowledge production and explore possible alternatives. This leads us to a broader issue: How should ethics, as an academic discipline, position itself in relation to this framework, to the science it draws upon, and to the problems it raises? And with that, we find ourselves once again back in that scene from *The Hitchhiker's Guide to the Galaxy*.

It is worth noting that the *Deep Thought* scene is not simply a parody of science and technology; it also offers an unflattering portrait of philosophy (Pawlak & Joll 2012). In it, two philosophers protest against outsourcing existential human questions to computational processes. Their objection is not without merit, but their performance quickly descends into posturing and professional vanity. *Deep Thought*, ever cunning, offers them a more lucrative path: public debates – mock battles over the answers it might one day produce. The philosophers agree, motivated less by epistemic virtuosity than by the promise of visibility and reward. While philosophers are not portrayed favourably in this episode, it nonetheless raises further questions that are highly relevant for this volume.

First: What kind of ethics do we need to grapple with the serious questions raised by the planetary boundaries framework? Second: Is it sufficient to accept technical or scientific constructs such as this framework at face value and merely reflect on their implications – as mentioned earlier? Might ethics not also need to contribute to the search for alternatives, helping to move reflections on 'safe operating spaces for humanity' beyond entrenched epistemic paths and towards new horizons of thinking and imagining?

And so, we come full circle – back to the introduction of this volume, where Jeremy J. Schmidt warned against uncritically accepting the planetary boundaries framework as the perimeter of justice. The ethics of planetary boundaries must begin earlier – by critically engaging with the assumptions built into the framework itself. It must also extend further – into epistemic territories left uncovered or ignored by the framework.

29.2 Keeping It Complex

With this volume, we set out to open the discussion on the many different ethical perspectives that emerge from the planetary boundaries framework. Our aim was to move beyond the ethical reflections suggested by the framework's creators and to bring into view a wider set of perspectives (e.g., Rockström et al. 2023). To this end, we invited scholars from a range of disciplines – each with their own methodological approaches and writing styles – and engaged them in ethical dialogue on the planetary boundaries framework.

Reflecting our conversations, one way to think across the many different engagements with the planetary boundaries is to treat the framework as akin to a

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boundary object. As the US-American sociologist Susan Leigh Star explains, such objects

> 'sat in the middle' between different groups, very ill structured or sketchy in the common usage. (Star 2010: 608)

Precisely because of this openness, such objects remain malleable enough to enable communication across disciplinary or conceptual divides. To illustrate this point, Star refers to David Ferrier's map of the human brain, which he created based on his studies of great ape brains. Yet, Star (2010: 608) wonders:

> Anatomically, this is the functional equivalent of taking a map of the Paris subway and superimposing it on Cleveland, and using it to talk about traveling around Cleveland, reasoning that all large cities essentially have the same sort of transportation infrastructure, just as all mammals, or primates, have the same localization of function in the brain.

How, Star asks, could such a scientific artefact have achieved the medical success it did? Her answer is:

> [T]he map did not need to be accurate to be useful. It could serve as the basis for conversation, for sharing data, for pointing to things without actually demarcating any real territory. (2010: 608)

In one sense, the planetary boundaries framework performs a similar function – even for those who remain highly critical of it and believe it to be inaccurate. As Ulrich Brand et al. (2021: 268) observe:

> [T]he notion of planetary boundaries went beyond the mere presentation of scientific results to change the frame of popular debates and to inform subsequent research on sustainability issues. However, the diagram is a simplification – while easy to communicate, it suppresses the complexity of different planetary processes as well as their interlinkages.

Treating the planetary boundaries framework as something akin to a boundary object proved to be a productive choice for initiating interdisciplinary dialogue. It did not require the contributors to this book to take any particular stance on the framework, thereby allowing them to enter into the ethical debate on specific boundaries from within their own academic, and non-academic, lifeworlds.

The result is a book that raises many ethical questions and offers possible answers to some of them, while never claiming to have charted the full terrain of an ethics of planetary boundaries. Such an approach may disappoint some readers – who might, in their desperation, recall the two philosophers from *The Hitchhiker's Guide to the Galaxy*. Yet in this volume, we follow the advice of Andy Stirling: when knowledge is uncertain, 'experts should avoid pressures to simplify their advice' and instead 'keep it complex' (Stirling 2010: 129).

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29.3 Knowing What the Question Is

As might be expected given the methodological orientation outlined earlier, the contributors to this volume engage with the epistemic resources of the planetary boundaries framework in ethically diverse ways. Some agree that the framework knows what its question is – to borrow the phrase from *The Hitchhiker's Guide to the Galaxy* – and proceed to explore its implications through a range of ethically follow-up inquiries. Others do not share this conviction, and instead foreground ethical concerns regarding the framework's knowledge production processes or unravel the implicit moral judgements articulated within the framework's corpus. Finally, the volume includes contributions that address the phenomena the planetary boundaries describe, without placing the framework at the centre of their ethical reflections.

29.3.1 Ethical Implications of Accepting the Framework

Among the authors who broadly align with the planetary boundaries framework, Konrad Ott, for example, outlines foundational building blocks for the development of ethical guidelines aimed at supporting responsible action in response to ocean acidification. James Elser, by contrast, turns his attention to the type of actor necessary to enable the sustainable use of phosphorus. He introduces the figure of the *system innovator* – an actor who, beyond possessing deep technical expertise, must also be capable of effectively communicating knowledge and navigating complex ethical, political, and cultural terrains. Neelke Doorn and Rachel Haug Fossbakk both engage with risk-ethical dimensions in decision-making processes concerning the management of freshwater systems and ocean acidification, respectively.

Even among those contributions that recognize a given planetary boundary as scientifically appropriate, there is a shared emphasis on the fact that the framework, on its own, cannot offer moral guidance. For scientific knowledge to inform action, it must be complemented by practical knowledge and ethical judgement – a point Jeremy J. Schmidt makes in Chapter 23. Moral orientation cannot be derived from science alone. Rather, sound guidance for action requires what has been termed *mixed moral judgements* – a consistent integration of various forms of descriptive knowledge with normative principles (Düwell 2013; Potthast 2015).

Doorn explicitly addresses the critique that the planetary boundaries framework fails to provide normative direction. She does not regard this as a flaw. On the contrary, she sees the framework as offering a valuable structure – one that is deliberately open, thereby allowing space for normative reflection and contestation within concrete contexts of application.

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It is at this point that one fault line within this volume becomes visible. Some contributors challenge the notion that the planetary boundaries framework is a purely scientific analysis of Earth system processes, and the idea that it simply sets the stage for subsequent ethical deliberation. It is to these contributions that we now turn.

29.3.2 Looking for 'Epistemic-Moral Hybrids'

Some contributions critical of the planetary boundaries framework are acutely aware of the extent to which it has become a focal point for the co-production of knowledge (Bremer & Meisch 2017). Critical perspectives therefore draw attention to the epistemic components constituting the framework's foundations. They invite a closer examination of the explicit and implicit normative and evaluative assumptions embedded within the framework. These assumptions require critical scrutiny to prevent the unreflective reproduction of potentially morally problematic notions. In this context, we are particularly concerned with what Thomas Potthast terms *epistemic-moral hybrids* (which Eser's chapter on biodiversity also touches on), that

> are historically contingent specific blends of scientific practices and normative agendas. They comprise a merging of practical actions, concepts, implicit and explicit agendas of protagonists and the epistemological and moral substructure which emerges. (Potthast 2015: 143)

We will now turn to some key points of criticism regarding constitutive elements of the planetary boundaries framework such as its notions of humanity, boundary, science, and temporality.

29.3.3 Implicit Ideas of Humanity

Many of the contributions, in one form or another, return to the central placement of 'humanity' within the planetary boundary framework's conceptual core. Two primary lines of critique emerge. First, given that many of the environmental challenges addressed by the framework are anthropogenic in nature, it seems questionable to focus exclusively on humans while neglecting the concerns of non-human beings. Second, the framework's homogenising view of humanity effaces the social, cultural, and political diversity that characterises human societies, and it also flattens the varied responsibilities, vulnerabilities, and relations of care that exist within and across them.

Several authors criticize the anthropocentric orientation of the planetary boundaries framework, noting that it implicitly presumes that only human interests

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count morally. Given that it is human activity that has brought about the critical state the framework identifies, many contributions to this volume support a stronger ethical consideration of non-human life forms and ecological systems. For example, Rachel Haug Fossbakk advocates for an ecocentric approach to ocean governance. Similarly, in their contribution on land use, Joana Castro Pereira and Carlota Houart call for a multispecies ethics and promote the idea of *forestzenship* – a concept grounded in the idea that humans and forests constitute a more-than-human political community. Such approaches assign moral value to the lived, situated relationships between humans and the natural environments they inhabit (see also Chapters 7 and 13). Christine Winter offers a more radical critique of anthropocentric framings by placing relational ethics at the heart of her account. She contends that moral value lies not only in individual organisms – whether human or non-human – but also to the relations that constitute and sustain them including those involving non-living entities such as ozone. What unites these perspectives is their shared concern with the questions of who belongs to the moral community 'in a safe operation space', and on what grounds (which Konrad Ott addresses in a different way in Chapter 22).

Many contributors challenge the reductive dichotomy between 'human' and 'nature' that underpins much of modern environmental discourse. Such a binary not only misrepresents the complexity of actual human–nature relationships, but also reasserts a particular Western ontological framework. By universalizing this view within the planetary boundaries framework, alternative ways of knowing and being in the world – especially those of Indigenous and marginalized communities – are sidelined or rendered invisible. This concern is taken up in different ways by Christine Winter (on ozone), Nicole Wilson (on water), and both Uta Eser and Makere Stewart-Harawira, respectively (on biodiversity). These authors call for acknowledging the moral significance of these relationships as essential to meaningful human lives. Rather than objectifying elements of non-human nature, they emphasize the importance of understanding them within the web of relationships they share with humans.

In addition, many contributors to this volume find another aspect of how the framework views humanity to be problematic. Like the metaphor of the Anthropocene (Lövbrand et al. 2015), the planetary boundaries framework risks presenting humanity as a singular agent, thereby obscuring global inequalities in exposure to environmental harms, as well as in responsibility for their creation. It is far from clear that the 'safe operating space' envisioned by the framework would, in fact, be safe – or just – for all. Nor does the framework adequately account for the fact that some groups and actors disproportionately benefit from the systems that drive planetary degradation, while others bear the brunt of the consequences. Several contributions draw attention to the socio-structural

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underpinnings of these dynamics – structures that are implicated in the environmental phenomena the framework seeks to describe, yet which are concealed by its generalising language. These include Uta Eser on biodiversity, Christine Winter on ozone; and Katerina Teaiwa on phosphorus). Erle Ellis (in Chapter 28) similarly argues that it is not humanity in the abstract – the Anthropos – that is responsible for planetary disruption, but specific forms of social organization. While all organisms inevitably modify their environments through metabolic processes, Ellis emphasizes how human cultures have scaled these effects up through historically contingent systems of production and power. If the planetary boundaries framework is to serve as a genuine 'wake-up call', Ellis contends, it must confront these social structures and the asymmetries of responsibility they entail.

Thus, for two key reasons, the contributors to this volume critique how the framework coproduces the idea of 'humanity'. First, it risks masking real suffering and injustice by presenting environmental degradation as a universal, undifferentiated human problem. Second, it deflects attention from the concrete actors, institutions, and systems that drive ecological harm – and from the unequal burdens borne by those with the least responsibility. The focus on 'humanity' effectively naturalizes the causes of ecological crisis, attributing them to the species rather than to the logics of capital accumulation, cost externalization, and global inequality. Several contributions identify the growth-oriented, capitalist mode of production as a primary driver of ecological overshoot – one that must be named and addressed if we are to move beyond mere symptom management.

29.3.4 Implicit Ideas of Science

A further explicit ethical issue arises in relation to the coproduction of boundaries since defining boundaries is never morally neutral. Even retreating to a putative position of scientific objectivity does not help, because, as Richard Rudner argued, scientists *as scientists* make value judgements when it come to the criteria for accepting a hypothesis:

> For, since no scientific hypothesis is ever completely verified, in accepting a hypothesis the scientist must make the decision that the evidence is *sufficiently* strong or that the probability is *sufficiently* high to warrant the acceptance of the hypothesis .... *How sure we need to be before we accept a hypothesis will depend on how serious a mistake would be*. (Rudner 1953: 2; italics in original)

In relation to social risk management, Steve Rayner and Robin Cantor (1987: 3) make a similar case, posing the question, 'How fair is safe enough?' They conclude that the answer to this question cannot be left to the technical experts alone. When

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looking for policy options in matters of risk, Rayner and Cantor argue, social debate needs to be grounded 'on the explicit basis of social conflicts over trust and equity, rather than on rival estimates of the probability and magnitude of unlikely events' (1987: 5). It is thus a point of criticism that the development of boundary values for a 'safe operating space' is not transparent and largely determined by technical experts, and that the values thus obtained should be considered the perimeter for ethical considerations (see Chapters 1, 6, and 27).

Related to the aforementioned, there are also criticisms about understandings of science that follow the linear model of scientific expertise and promise certain control over natural and social processes through objective scientific knowledge. Contributions in this volume draw attention to several morally problematic aspects of this model of science. For example, it tends to engage in forms of reductionist knowledge production that removes its objects of study from their contexts to examine them in isolation. Such isolation has moral consequences if it narrows the object of ethical reflection and creates or reproduces forms of epistemic injustice. This means that epistemic agents and their epistemic resources are wrongfully excluded from the production of knowledge and the ethical reflection that goes with it. Contributors such as Christine Winter (on ozone) and Nicole Wilson (on water) therefore argue for understanding these substances in their social relationships and not just as simple molecules. Similarly, Makere Stewart-Harawira discusses the different ontological conceptions of human–nature relations in international biodiversity documents as compared to those of Indigenous peoples, which do not rely on notions of nature–culture divide, and which are precisely what matters when it comes to protecting biodiversity.

29.3.5 Implicit Ideas of Time

On closer examination, we can also see that many contributions in this volume engage with the ethical implications of time, temporality, and the future. This is hardly surprising, given that the planetary boundaries framework is fundamentally concerned with shaping the future in such a way that 'a safe operating space for humanity' can be maintained. Statements about 'the future' are, to some extent, reflections of how individuals and communities conceptualise time itself, as well as the scope of human agency within spatio-temporal structures (Adam 2005; Hanusch & Meisch 2022).

One way to explore the different ways in which time is understood in epistemic resources like planetary boundaries framework is to pay attention to how scholars think about the many possible relationships between past, present, and future – and the values and assumptions that always come with them (Adam 2023: 285). In this respect, time scholar Barbara Adam (2023, 2024) distinguishes four perspectives

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Table 29.1 *Epistemic perspectives of researchers on the future (Adam 2023, 2024)*

Temporal orientations	Perspectives on the future	Normative implications
Present futures	Perspective of the present on an immaterial not-yet	The future is understood as open terrain to be shaped by present actions.
Future presents	Perspective of a future person on their present	The future is understood as colonized by the present decisions (or 'time prints of action').
Past futures	Perspective of a past person on their future	The present is understood as the future of the past.
Future pasts	Perspective of a future person on their past	The present is understood as the past of the future and as a time to take responsibility for the future.

(see Table 29.1), which offer a useful framework for organizing the insights emerging from this volume at the intersection of ethics, temporality, and the planetary boundaries discourse. As Adam (2023: 285) emphasizes, 'what we can see and understand by taking these different standpoints depends fundamentally on assumptions about the reality status of the future, that is, whether we accord the future processual reality status or bracket it as an immaterial realm of ideas only'.

From the perspective of time studies, we might say that the core idea of the planetary boundaries framework does not assume the future to be an 'immaterial not-yet'. On the contrary, the model clearly acknowledges that past human decisions have significantly constrained the scope for future action. The research team behind the planetary boundaries framework is concerned with safeguarding the remaining room for manoeuvre – placing it within 'a safe operating space'. Thus, although the future is no longer presented as entirely open, the scientists involved in the framework maintain that it remains, at least to some extent, shapeable. This impulse is taken up by authors such as Neelke Doorn, James Elser, or Rachel Haug Fossbakk, who argue for ethically responsible pathways towards *present futures*.

Christine Winter and Jeremy Schmidt, each in their own way, adopt a *future present* perspective, exploring distinct *time prints* through which the future present is colonized by its past – namely, our current present. Christine Winter elaborates how the planetary boundaries framework contributes to legitimise an atmospheric enclosure, rendering the atmosphere available for private pollution. In doing so, she argues, the scope for action available to future generations will be severely constrained. Jeremy Schmidt, in turn, offers a critical analysis of how present-day decisions regarding geoengineering may profoundly shape the lives of future

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people, who could find themselves locked into maintaining inherited technologies they did not choose but must sustain.

Katerina Teaiwa and Alice Benessia are concerned with tensions within the present. They look upon the present as *past future* that, under the banner of human progress, has repeatedly destroyed the lifeworlds of specific communities and imposed heavy burdens upon them. The current devastation on the island of Kiribati or in a Northern Italian landscape is the result of a once-glorious future imagined by the past. Both texts also reveal a struggle for epistemic forms through which responsibility for the future might be assumed in the present – forms that do not rely on the techno-scientific mastery of human lifeworlds. What emerges in their contributions is a present that is at once unsettling and wounded, a moment in which *future pasts* have already begun.

An interesting perspective on the complex interplay between ethics, time, and the governance of planetary boundaries emerges in two contributions focusing on international law and treaties. Louise du Toit (on ozone) and Leslie-Anne Duvic-Paoli (on aerosols) examine how *present futures* might be shaped more equitably through global governance. They also highlight that debates on international regulation must reckon with the *time prints* of the past – the enduring consequences of earlier decisions – now (i.e. in the *past future*) manifest in ozone-depleting substances, CO_2, and air pollution that have steadily accumulated in the atmosphere, profoundly affecting the lives of many who bear no responsibility for their presence.

29.3.6 Implications for the Governance of Planetary Boundaries

The authors of the planetary boundaries framework have, from the outset, been guided by an intention to have a societal impact (Sörlin 2025), a motivation that has become increasingly visible in recent publications that the planetary boundaries are a guide for the future (e.g. Rockström et al. 2024a, b). As noted earlier, however, a tension emerges: while the natural science strand of the corpus continues – against all plausibility – to retreat to a position of scientific objectivity, the growing normative dimension makes increasingly visible the ambition to evolve into a form of *scientific cosmology* (see Allan 2018), one that seeks to influence political action at all levels (on the issue of the planetary boundaries framework as a scientific cosmology, see Meisch & Schmidt, n.d.).

Many contributors to this volume engage critically with knowledge-making processes at the science–society interface of the planetary boundaries framework. A central question is what forms of agency and concepts are required to respond effectively to the challenges posed by each planetary boundary. James Elser introduces the notion of the *system innovator* who acts as a *boundary persona* – a

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trusted intermediary who connects actors from disparate domains and thereby facilitates cooperation and collective transition towards more sustainable practices. Taking a more radical position, Christine Winter advocates for what she terms 'an anticolonial planetary (non)boundary'. For her, addressing planetary challenges ethically and politically requires a fundamental reorientation of knowledge production. This involves engaging with relational epistemologies and ontologies that decentre the human and actively challenge Western patterns of thought. An anticolonial approach to planetary studies thus entails the inclusion not only of all human perspectives, but also of the elemental, the geophysical, and the more-than-human world. Building on such relational approaches, Miriam Gay-Antaki calls for more inclusive methodologies of knowledge production and proposes the idea of *border crossing* as an epistemological method. This practice explicitly rejects the conventional Western ideal of an objective, detached observer. Instead, it values knowledge produced by situated knowers – individuals whose insights are shaped by their sociopolitical positions, experiences, and histories. Border crossing invites us to expand our epistemic repertoire by confronting colonial categories and recognizing that all knowledge is situated. The idea of border crossing is informed by the concept of *world-travelling*, developed by Maria Lugones (1987) and Mariana Ortega (2006). Such world-travelling

> has to do with actual experience; it requires a tremendous commitment to practice: to actually engage in activities where one will experience what others experience; to deal with flesh and blood people not just their theoretical constructions; to learn people's language in order to understand them better not to use it against them; to really listen to people's interpretations however different they are from one's own; and to see people as worthy of respect rather than helpless beings that require help. (Ortega 2006: 69)

Elsewhere, Kristie Dotson (2012) draws on this tradition to address more systemic forms of epistemic injustice. She highlights how dominant epistemic systems may appear seamless and authoritative, yet fail to provide the epistemic resources needed for just and adequate responses to complex problems. In such contexts, the task is not to merely refine these existing epistemic systems, but to acknowledge their limits – and to actively seek out alternative forms of knowing that have long been excluded or marginalized. This theme runs through several contributions in this volume, including Alice Benessia (on land use), Tanguy Sandré and Jeanne Gherardi and Miriam Gay-Antaki (both on climate), Makere Stewart-Harawira (on biodiversity), or Katerina Teaiwa (on phosphorus).

Several contributors critically examine the way specific planetary boundaries are framed as problems, drawing attention to related governance challenges. Louise du Toit addresses the issue of *problem shifting*, which occurs when regulatory problems fall outside the scope of international agreements – or are deliberately pushed beyond their remit. Similarly, Leslie-Anne Duvic-Paoli highlights how the

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planetary boundaries framework fails to capture the regulatory complexities associated with aerosols. Regarding novel entities, Andreas Bachmann and Ariane Willemsen argue that the way in which the boundary aggregates a wide range of disparate substances under a single planetary dimension risks obscuring the fact that individual substances may pose specific challenges in relation to the domains of other boundaries – for instance, gene drives in relation to biodiversity.

Several contributors also draw attention to the shifting political landscape shaped by the rise of right-wing populist parties and the increasingly brazen political influence of ultra-wealthy individuals who have little interest in regulations that might curtail their sources of income – even when those very sources are directly implicated in environmental degradation and social injustice. Makere Stewart-Harawira (on biodiversity), Katerina Teaiwa (on phosphorus), and Erle Ellis (on novel entities) all explore these entanglements in different ways. Notably, Allan (2018), in his already mentioned work on *scientific cosmologies*, discusses anti-scientific sentiment and the ascent of right-wing politics as key reasons why cosmologies such as the planetary boundaries framework may be losing political traction – even as the socio-environmental dynamics and normative challenges the framework seeks to describe persist.

29.4 Glimpses of an Ethics of Planetary Boundaries

This volume sets out with a clear intention: to reveal a wide and diverse a panorama of ethical reflection on the planetary boundaries. As editors, we have deliberately refrained from prescribing how the contributors ought to understand *ethics*. Instead, each author was free to highlight the aspects that they consider most significant. In this way, the book brings together a constellation of different approaches and ways of thinking about planetary boundaries. This summary can only cast a few glimmers of light on this wealth of perspectives – always with the guiding question in mind: What kind of ethics do we need to address the planetary boundaries?

Since the term *ethics* can mean different things in different contexts, it is helpful to clarify its philosophical meaning as a postlude to thinking about how different chapters in this volume proceed (Düwell 2013; Tugendhat 1993; Williams 1985). In philosophy, we usually speak of ethics when the reflection on morals is not merely intuitive or rooted in everyday judgement, but pursued systematically (Ricken 2012; Stoecker et al. 2011). Morals, in this sense, refer to the shared set of beliefs within a community about what is of value (values) and what ought to be done (norms). Normative ethics, in turn, does not stop at describing or reconstructing these beliefs; it probes deeper – asking for the reasons that sustain these beliefs and justify their validity.

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What does it mean to *do ethics*? Onora O'Neill (2009: 220–221) distinguishes between two fundamental approaches: one treats normative claims as *objects of study*, the other as the *proper aim* of ethics. O'Neill clearly argues for the latter. Yet, for this volume both perspectives are relevant, for it matters first to identify the moral concerns in relation to which moral principles must be formulated and justified. For any future engagement with ethics, it is crucial to be aware that whichever of these two options one chooses, different language games and ethical skills come into play.

To regard normative claims as *objects of study* means to analyse and reconstruct them, particularly those implicit norms that shape specific fields of action. Such an approach is often driven by an emancipatory impulse: through a critical theoretical lens it seeks to uncover injustices embedded in these fields. This volume, for example, includes contributions that explore planetary boundaries through the lenses of political ecology, feminist theory, postcolonial critique, or critical Indigenous Studies – such as Nicole Wilson on water, Miriam Gay-Antaki on climate, or Makere Stewart-Harawira on biodiversity.

The second approach highlighted by O'Neill aims at grounding normative claims, clarifying the contexts in which they apply, and reflecting on political contexts or institutions designed to avert moral dilemmas where possible. Examples of this approach can be found in Christine Winter's call for a relational ethic, Jeremy Schmidt's discussion of ethical experimentation, or in Konrad Ott's argument for a deep anthropocentrism. Ott's contribution provides an instructive example of how competing ethical perspectives can be carefully weighed. He examines their respective strengths and weaknesses and adopts a well-reasoned position considering a concrete case, that is, ocean acidification. As discussed earlier, the planetary boundaries framework has provoked justified critique because of its anthropocentric focus.

These aspects of the book relate closely to an intense debate within the fields of environmental and nature ethics. As Angelika Krebs (1999: 137) compellingly argued, this debate is often framed as a stark opposition: on the one hand, a narrowly instrumental form of anthropocentrism, which reduces nature to a resource for limitless human satisfaction; on the other, a form of absolute physiocentrism, which posits nature's intrinsic value as beyond question. Krebs points to the possibility of more nuanced positions that acknowledge nature's manifold value for flourishing human lives, while also recognizing that humans, as moral agents, attribute value to nature as part of their moral cultures. For instance, Konrad Ott brings a mediating position into focus. Several other contributions in the volume highlight similar approaches – for instance, Uta Eser on biodiversity, Christine Winter on ozone, and Alice Benessia on land use change.

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The discussion of environmental and nature ethics reflects a core characteristic of an ethics of planetary boundaries as such: the nuanced weighing of ethical positions in response to specific moral problems, aiming to provide a well-reasoned basis for action. An example for this is the contribution by Andreas Bachmann and Ariane Willemsen on novel entities. They critically examine ethical principles found in planetary boundaries literature – such as the harm principle, the precautionary principle, and risk-based approaches. Drawing on their experience from ethical advisory work within political organizations, Bachmann and Willemsen demonstrate the potential for nuanced ethical reasoning and affirm that ethics can and need to provide guidance even in the face of uncertainty.

Perspectives that take their cue from social ethics turn our attention to the political and legal structures that frame human action. For instance, the contributions by Neelke Doorn on water and Christine Winter on ozone explicitly draw upon the tradition of political philosophy. Social institutions shape the conditions under which action unfolds, and as such hold the potential either to enable responsible conduct or, at the very least, to dismantle the conditions fostering unjust practices, such as hermeneutical or contributory injustices (Dotson 2012; Pohlhaus 2019). In this volume, two contributions examine the ethical dimensions of international legal instruments designed to address the challenges posed by ozone depletion, by Louise du Toit, and air pollution, Leslie-Anne Duvic-Paoli. Another social-ethical focus is offered by Joana Pereira and Carlota Houart. They critically analyse global and national bioeconomy policies that impede a fairer use of land in the Amazon region and propose *forestzenship*. Similarly, other authors argue for recognizing non-human nature as an integral and systematic part of human social organization – for instance, Rachel Haug Fossbakk on oceans, Christine Winter on ozone, Makere Stewart-Harawira on biodiversity, or Alice Benessia on land-use change. Such considerations might also be captured by what the political scientist John Dryzek called *socio-ecosystemic reflexivity*, that is,

> the incorporation into human institutions of better ways to listen to ecological systems that have no voice; and an ability to re-think what core values, such as justice, mean in the context of an active and unstable Earth system. (Dryzek 2016: 9)

From all the contributions in this volume, one insight becomes unmistakably clear: any ethical engagement with planetary boundaries must be, at the very least, interdisciplinary – if not indeed transdisciplinary. The challenges are so complex that they can only be meaningfully addressed by working collaboratively on questions and methods across a variety of epistemic agents. Such collaboration arises necessarily from the very problem structure of these challenges, which Silvio Funtowicz and Jerry Ravetz (1993) described as *post-normal* – that is, when 'facts

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are uncertain, values in dispute, stakes high, and decisions urgent'. In this volume, Konrad Ott describes ocean acidification as a post-normal problem. Such inter- and transdisciplinary collaboration leads to forms of knowledge that are epistemically better. At the same time, it is a matter of epistemic justice, for all epistemic agents have a right to participate in those processes of knowledge-making that concern their lives and their worlds (Meisch 2024a, b; Meisch et al. 2022). This requires two potentially opposing skills: the ability to understand the knowledge claims of other epistemic agents, as well as to unlearn, relearn, and critically question established forms of knowledge and habitual ways of thinking. For ethics, this also means embracing an old, yet ever-pertinent, insight: no one is free of prejudice – but we can train ourselves to recognize and critically examine our biases (Mieth 1993). In this spirit, for instance, Miriam Gay-Antaki, Tanguy Sandré, and Jeanne Gherardi (all on climate) call for an especially self-critical and reflective stance.

The texts by Katerina Teaiwa on phosphorus and Alice Benessia on land-use change stand out for their particular moral stance, as they express both grief and pain at the devastation that has already occurred, as well as hope that healing the natural world may still be possible through active, creative work and knowledge-sharing. Their moral approach resonates with the call to 'stay with the trouble' (Haraway 2016) or with the conscious willingness to confront the precarious (Tsing 2015). They write from the vantage point of embodied experience with a damaged natural environment and the new, meaningful relationships that can emerge from it. In doing so, they also draw our attention to the fact that the destruction of the natural environment is not something external to humans but is experienced in and through human bodies – it passes through them, quite literally, as Adam Dickinson (2018) poignantly reveals elsewhere in his poetry collection *Anatomic*. There, he gives voice to his horror at the traces of what he calls 'petro-culture' has left within his own bodily tissues, mapping where and how novel entities have inscribed themselves into the material fabric of his being. In such a context, Katerina Teaiwa and Alice Benessia invite us to critically contemplate the conditions under which human flourishing remains conceivable in contexts of socio-environmental degradations.

29.5 Knowing What the Question Is

The planetary boundaries framework has become a key reference point for reflecting on, and guiding, state action in response to the central challenges of the human environment. Originating in the Earth system sciences and enriched by insights from other fields, it has also been adopted in legal studies (e.g. French & Kotzé 2021; Kim & Kotzé 2021) and political science (Biermann & Kim 2020). Its

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influence now extends across a wide spectrum of political institutions at local, regional, national, and global levels – most notably the UN – as well as business organizations such as the World Business Council for Sustainable Development and NGOs including WWF (Rockström et al. 2024a). A major achievement of the framework lies in broadening the narrow focus on climate change to encompass other critical challenges of global environmental policy, while fostering collaboration across diverse disciplines. Yet, precisely because it has assumed such prominence, it cannot be taken as an unquestioned perimeter of justice but requires constructive and critical ethical reflection – an inherently inter- and transdisciplinary task to which this volume seeks to contribute.

Let's return to Douglas Adams's *The Hitchhiker's Guide to the Galaxy*. The argument of this conclusion has been that there are ethical consequences if the planetary boundaries framework does not actually know its own question. How, then, do the authors in this volume position themselves in relation to this issue?

Obviously, no straightforward yes-or-no answer was to be expected. The contributors' responses vary considerably, and it was never the aim of this volume to arrive at a definitive or univocal judgement. What unites all contributions, however, is the shared recognition that the epistemic and ethical dimensions of the planetary boundaries framework are deeply intertwined and cannot meaningfully be considered in isolation. This, in turn, raises the question of what forms of ethical reasoning are needed to address the framework's normative and evaluative challenges.

The glimpses into the wealth of perspectives gathered in this conclusion allow us to trace certain threads, outlining forms of ethical reflection from which an ethics of planetary boundaries might be woven. Readers will notice that the contributions, although largely written independently, enter a kind of conversation: complementing one another, at times challenging each other, and together opening space for dialogue. It is striking how ethical arguments developed with respect to one planetary boundary can yield valuable insights when transferred to others. In this sense, the volume is best understood as a convergence of ongoing conversations – conversations in which different ethical approaches critically and constructively test their foundations, examine their core concepts, and jointly explore possibilities for moral action in pursuit of futures that matter, and fair ways of achieving them.

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