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## The Moral Geography of the Earth System

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Keywords:	Moral geography, Anthropocene, grundnorm, technosphere, neoliberalism, sustainability
Abstract:	<p>Human impacts on the Earth system have profound moral consequences. The uneven generation and distribution of harms, and the acceleration of human forces now altering how the Earth system functions, also trouble moral accounts of belonging. This article shows how moral geography can be renewed in this context. It begins by identifying how human impacts on the Earth system are shifting global norms of sustainability, such as in calls to enhance planetary stewardship and to transform social values. These shifts are important in themselves, but also reveal a deeper challenge to moral geography and the counterfactual heuristics traditionally relied upon to understand belonging. In response, many critical scholars have rethought the terms and conditions of belonging in the Anthropocene in reference to considerations of novelty, time, ontology, and agency. I argue that these strategies face difficulties that are not only analytical, but which also arise from new practices of belonging that accept critiques yet reach markedly different conclusions. I examine two cases of this kind. The first treats human forces as a geological sphere: the technosphere. The second incorporates the planetary boundaries framework of Earth system science as the basis for a grundnorm (a norm basic to all others) in international programs of environmental law and governance. Examining these two practices within the broader context of shifts in sustainability reveals a new politics of naturalization unperturbed by critical scholarship on the Anthropocene. By contrast, a renewed moral geography can identify how earlier norms of sustainable development, especially the promotion of economic instruments to secure environmental relief, now structure the incorporation of Earth system science in sustainability transitions. Retaining the structure of sustainability and accepting critiques of the Anthropocene are now giving rise to a new form of neoliberalism without nature.</p>

## The Moral Geography of the Earth system

### 1 INTRODUCTION

Chapter one, line one, of the World Commission on Environment and Development (1987, p. 39) report, *Our Common Future*, reads: “The Earth is one but the world is not.” It was and remains a remarkable statement that consolidates global environmental challenges and naturalizes the normative trajectory of sustainable development: the convergence of multiple social worlds on a single Earth. This article examines how the norms of sustainability are shifting in the Anthropocene in ways that demand a renewal of moral geography. The shift is evident in global governance, such as the Sustainable Development Goals (SDGs), when Earth system science is used as rationale to both constrain development within planetary boundaries and to compel social values, such as stewardship (e.g. Sachs, 2015; Steffen et al., 2015a). For instance, Steffen et al.’s (2018) landmark article showed how the planet could become “Hothouse Earth” if human impacts on the Earth system cross climate thresholds—a key planetary boundary—beyond which reductions of greenhouse gas emissions would not prevent climate destabilization and lead to average temperatures higher than any of the past 1.2 million years. Steffen et al. (2018, p. 8254) then argued preventing climate destabilization and achieving the SDGs requires “deliberate and sustained” efforts to enhance stewardship across the biosphere, climate, and societies—a task that requires a transformation of social values. Beyond its stark warning, the argument of Steffen et al. (2018) shifts sustainability along three areas of concern to moral geography (cf. Smith, 1997): First, it *describes* practices that have moral dimensions because they lead to harms or goods. In this case, actions leading to climate destabilization. Second, it makes *normative* claims

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3 regarding what should be done: stewardship ought to be enhanced across the biosphere, climate,  
4 and societies. Third, it develops a *metaethical* argument regarding how to think differently about  
5 moral obligations in light of existing or expected conditions; an epoch in which humans alter the  
6 function and trajectory of the Earth system—the Anthropocene—requires transforming values  
7 (cf. Steffen et al., 2011, 2015b; Waters et al., 2016).  
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17 Descriptive, normative, and metaethical arguments regarding the Anthropocene are not  
18 usually referenced to moral geography.<sup>1</sup> As Section Two shows, part of this can be traced to how  
19 critical scholarship on the Anthropocene unsettles moral geography and the counterfactual  
20 heuristics that use ‘other’ spaces, places, or landscapes to challenge naturalized notions of  
21 belonging. A second reason, however, is that critical scholars often use the Anthropocene to  
22 recast notions of belonging in reference to considerations of novelty, time, ontology, and agency.  
23 This strategy has limits that are not only analytical. As Section Three shows, critical scholars  
24 often have targets to the side of practices already shifting norms of sustainability, and notions of  
25 belonging, in the Anthropocene. I examine two such cases: one treats humanity’s life support  
26 system as a geologic sphere—the technosphere—an idea circulating among Anthropocene  
27 Working Group members to assess the spatial and scalar burden of humans on the Earth system.  
28 The second uses planetary boundaries to establish a *grundnorm* (a norm basic to all others) in  
29 international environmental law and to provide a rational and empirical basis for the SDGs.  
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49 In light of new practices of belonging that are unperturbed by critical scholarship on the  
50 Anthropocene, Section Four argues that a renewed moral geography must attend to a new  
51 politics of naturalization now taking shape. This form of naturalization does not presume that the  
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3 integration of ‘many worlds’ to one Earth is value-neutral; an idea long-rejected given that every  
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5 view of the Earth is situated in a social world. Instead, this form of naturalization treats human-  
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7 Earth integration as empirical fact, not normative aim. It accepts critical rejections of nature as a  
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9 non-social sphere. It agrees Anthropocene novelty generates a mismatch between human and  
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11 geological time, and that non-human agency inflects the multi-causal account of human impacts  
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13 on the Earth system. It is from these propositions, in fact, that the new politics of naturalization  
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15 combines descriptive, normative, and metaethical claims into a moral geography of the Earth  
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17 system. This new politics of naturalization, evident in the technosphere and an emerging  
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19 *grundnorm*, raise concerns resonant with those over how ‘systems thinking’ frames social or  
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21 biophysical integration (MacKinnon and Derickson, 2013). But the new politics of naturalization  
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23 does more than frame integration. It begins with the proposition that integration has happened.  
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25 This proves both impetus and catalyst for shifting sustainability from seeking integration through  
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27 market instruments—so called ‘green neoliberalism’—to a form of neoliberalism without nature.  
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29 A renewed moral geography must engage with the politics that structure how new practices of  
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31 belonging naturalize, and further capitalize upon, Earth system processes.  
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## 40 2 ANTHROPOCENE CHALLENGES TO MORAL GEOGRAPHY

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44 At the turn of the millennium, Schellnhuber (1999) argued a 2<sup>nd</sup> Copernican revolution was  
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46 underway. It was a revolution unlike the first. Its aim was not to put Earth, and humans upon it,  
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48 in correct astrophysical context, but to evoke a cognitive shift that “...will enable us to look back  
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50 on our planet to perceive one single, complex, dissipative, dynamic entity, far from  
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52 thermodynamic equilibrium—the ‘Earth System’” (Schellnhuber, 1999, p. C20). Echoing  
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3 Schellnhuber's argument that the idea of the Earth system also required recasting sustainable  
4 development, Crutzen and Stoermer's (2000) call to recognize the Anthropocene came with an  
5 argument to enhance environmental management and engineering for sustainability. For critical  
6 scholars, however, interpreting Earth system science as a new 'Copernican revolution' tacitly  
7 repositioned moral possibilities between poles of enhanced control (e.g. geoengineering) versus  
8 reflexive humility in view of a system too complex to control (Lövbrand et al., 2010). Castree  
9 (2016) amplified the stakes of this shift by arguing that global change research is itself value-  
10 based. The timbre of such critiques is that one must not conflate what is with what ought to be.  
11 That is, the geologic forces wielded by humans do not naturally set moral options on an axis  
12 between enhanced control and humble retreat.  
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29 Revolution or not, the Anthropocene challenges moral geography, particularly the idea  
30 that "certain people, things and practices belong in certain spaces, places and landscapes and not  
31 in others" (Cresswell, 2005, p. 128). Typically, these 'other' spaces, places, and landscapes are  
32 important to how moral geography examines differences regarding the production, maintenance,  
33 and contests over belonging(s) (Sack, 1997; Proctor, 1998; Smith, 2000a,b, 2001). *Prima facie*,  
34 the Anthropocene appears to close off appeals to 'other' spaces, places, or landscapes owing to  
35 how all forms of belonging are now subject to an Earth system functionally altered through  
36 social actions. This challenge is not over how the environment is or has been used to naturalize  
37 intersecting issues of race, gender, or class (Livingstone, 1991; Harvey, 1996; Merchant, 2004).  
38 Nor, finally, is it about the orientation of moral geography to western philosophy, which has  
39 been criticized for the Eurocentric assumption that 'other' forms of belonging can or should be  
40 fairly made legible to western ethics (Preston, 2003, 2009; Tuck and Mackenzie, 2015). Those  
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3 concerns remain, as do those regarding the elevation of idealized accounts of injustice over  
4 spatially explicit accounts (Barnett 2018). Added to these is a methodological concern over the  
5 loss of counterfactual heuristics that use ‘other’ spaces, places, and landscapes to hold open  
6 possibilities for different forms of belonging. Counterfactual reasoning orients difference among  
7 possible forms of belonging to what has not happened or is not necessarily the case—to ‘other’  
8 spaces, places, or landscapes. Counterfactuals are used, for instance, to reject environmental  
9 determinism (using the environment to explain social difference) through appeals to ‘other’  
10 forms of belonging in similar environments or similar forms of belonging in ‘other’  
11 environments. The Anthropocene, however, appears to create conditions where the social  
12 alteration of how the Earth system functions overdetermines ‘other’ forms of belonging to space,  
13 place, or landscapes.  
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31           These concerns underwrite two related challenges. First, authors within and beyond  
32 geography argue that Eurocentric notions of ‘nature’ must be rejected. The quantitative evidence  
33 of human impacts on the Earth system compound qualitative arguments that reject the separation  
34 of ‘nature’ from human action (Clark, 2012; Yusoff, 2013; Lorimer, 2015; Moore, 2015; Purdy,  
35 2015). The upshot is that accounts premised on nature as a non-social ground upon which ‘other’  
36 forms of belonging take shape require renovation to incorporate the actions, forces, and  
37 processes of humans and non-humans (Bennet, 2010; Johnson et al., 2014; Adams, 2016;  
38 Lorimer, 2017). Second, accounts of ‘anthropogenic’ forcing on the Earth system that employ  
39 universal notions of the ‘human’ (*qua* species) are rejected (Malm and Hornborg, 2014; Castree  
40 et al., 2014). Here, the ‘other’ histories, agencies, and worlds mobilized to challenge the largely  
41 capitalist pathways structuring human impacts on the Earth system are not consigned to  
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3 reproduce Orientalism (cf. Said, 1978). Rather, differences among human or non-human ‘others’  
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5 premised on fixed or transcendental categories are rejected for immanent explanations of social  
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7 and geological phenomena coproduced across different life worlds (Tsing, 2015; Haraway, 2016;  
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9 Danowski and Castro, 2017; Weston, 2017).

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15 Tandem rejections of nature and naturalized ‘others’ are not blind to uneven geographies  
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17 nor to their study. Ghosh (2016) argues the counterfactual contrast of a stable Holocene versus  
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19 an unstable Anthropocene betrays bourgeois ideals of stability that those forced to hazardous  
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21 environmental margins have never enjoyed. Feminist scholars confront intersecting forms  
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23 oppression in the Anthropocene based in race, gender, class, and colonialism to articulate new  
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25 possibilities for solidarity, care, and belonging within and beyond human communities (Gibson-  
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27 Graham, 2011; Tolia-Kelly, 2016; Grusin, 2017; Hird, 2017). These insights challenge the easy  
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29 affiliation of attachment to place—belonging—with moral consideration by pointing out that  
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31 detachment also matters morally (Ginn, 2014). Moral considerations may extend, as Hale (2016)  
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33 put it, even to the wicked parts of the wild. The methodological implications prompt Lorimer and  
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35 Driessen (2014) to rethink inquiry in the Anthropocene as ‘wild experiments’ that cannot be  
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37 configured through fixed or transcendent categories that demarcate ‘other’ landscapes. Likewise,  
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39 Matless (2017) argues new vocabularies are now needed to articulate belonging, landscapes, and  
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41 time in the Anthropocene. Below, I consider four overlapping themes frequently used to rethink  
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43 the terms and conditions of belonging after the rejection of nature and naturalized ‘others.’ The  
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45 goal is not complete coverage but to consider how the limits of novelty, time, ontology, and  
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47 agency operate across descriptive, normative, and metaethical concerns in ways that demand a  
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49 renewed moral geography.  
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6 (1) *Novelty*. Echoing claims of a ‘2<sup>nd</sup> Copernican revolution,’ numerous scholars claim the  
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8 Anthropocene is novel—a new Earth of human making (Hamilton and Grinevald, 2015;  
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10 Nicholson and Jinnah, 2016; Parr, 2018). Novelty is often both descriptive and normative, such  
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12 as when the ‘no analogue’ state of the Earth system provides rationale to claim a ‘no analogue’  
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14 state for normative reasoning about what ought to be done (cf. Steffen et al., 2004). For instance,  
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16 Hamilton et al. (2015, p. 5, 8) argue the Anthropocene renders previous moral frameworks  
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18 inadequate because there has been “no biological adaption and no cultural learning” sufficient to  
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20 guide action under such novel conditions; as they put it, “Talk of ethics renders banal a transition  
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22 that belongs to *deep time*, one that is literally Earth-shattering.” This categorical rejection has  
23  
24 been critiqued for dismissing all cultural learning, especially non-Western knowledge and norms,  
25  
26 by fiat (Schmidt et al., 2016). There is another facet, however, to how Hamilton links novelty to  
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28 morality. The link is not metaphorical; it is unlike arguments that use geology to reimagine  
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30 morality in ways philosophically unfamiliar to geologists (e.g. Yusoff, 2017).<sup>2</sup> Rather, Hamilton  
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32 claims Earth system science provides for moral experiences previously unavailable in human  
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34 history.  
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42 Rejected Holocene morality, Hamilton (2017, p. 49, original emphasis) argues that only  
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44 a new anthropocentrism will allow humans to take “responsibility” for their geological actions as  
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46 “*the central agent in a new kind of Earth*.” Claiming earlier forms of anthropocentrism were “not  
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48 anthropocentric enough,” Hamilton (2017, p. 53) argues the empirical descriptions of Earth  
49  
50 system science require reimagining belonging to a transformed planet. He distinguishes his  
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52 position from those who critique the Anthropocene without attending to how it is only through  
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3 Earth system science that knowledge of human impacts on the Earth system is possible. Principal  
4 among Hamilton's (2017, p. 92) targets is Haraway (2016), whose notions of the Chtulucene,  
5 Capitalocene, or Plantationocene are dismissed as "terminological incontinence."<sup>3</sup> Haraway is  
6 not Hamilton's only target, but a foil for those he claims compromise on the full implications of  
7 Earth system science. By contrast, Hamilton (2017: p. 91, original emphasis) holds that humans  
8 must embrace "the blunt truth of the Anthropocene...in the book of life, man *is* the greatest story  
9 ever told."

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22 Hamilton's account faces challenges. First, Hamilton contradicts his rejection of  
23 Holocene norms by reviving anthropocentrism. Apparently, some Holocene morals are worth  
24 keeping, yet Hamilton supplies no satisfactory argument explaining which ones or why. Second,  
25 Hamilton's (2017) call for more anthropocentrism is structurally analogous to the 'compromise  
26 of liberal environmentalism' of sustainable development in the 1990s. At that time, economics  
27 gained legitimacy on the premise that markets would efficiently provide environmental relief and  
28 development opportunities, even though economic growth was widely critiqued as generating  
29 environmental harms (Bernstein, 2001). Hamilton's (2017) compromise equivocates a key driver  
30 of ecological malaise, anthropocentrism, with neoliberal terms of responsibility that are the  
31 outcome of 'blunt truth' as he puts it (cf. Brown, 2015). Third, Hamilton's (2017)  
32 anthropocentrism is all too ethnocentric. He offers no substantive engagement with notions of  
33 relationship, reciprocity, or obligation in other socio-cultural practices. Finally, as Sideris (2017)  
34 argues, eliding scientific and moral novelty ignores the importance of experience and place in  
35 everyday life. Global accounts of the type Hamilton offers often reveal more about the re-  
36 enchantment of science-as-narrative than they do about changing conditions for new forms of  
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3 belonging. Nevertheless, Hamilton's use of novelty upends counterfactual heuristics that imagine  
4 a place 'outside' the Earth system in the new time of the Anthropocene.  
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10 (2) *Time*. The historian Martin Rudwick (2007) offered a penetrating assessment of how geology  
11 'burst the limits of time' by extending history to scales beyond human existence. For  
12 Chakrabarty (2009), however, the Anthropocene raises new questions of time because it requires  
13 linking temporal scales of geology, planetary science, and human history. Attempts to bridge  
14 different temporal scales produces rifts, Chakrabarty (2014, 2017) argues, owing to the  
15 incommensurable times used in accounts of geology and human history required to explain  
16 human impacts on the Earth system. The consequence, for Chakrabarty (2018, p. 8), is that the  
17 Anthropocene is never "completely separated from moral concerns." Rather, the new "geology  
18 of morals" requires that belonging be configured amid incommensurate temporal scales  
19 (Chakrabarty, 2016). In one sense, 'rifts' over different notions of lived versus scientific time  
20 between the social and natural sciences are not new, as the famous showdown between Bergson  
21 and Einstein made clear a century ago (Canales, 2015). What occupies Chakrabarty (2017,  
22 2018), however, is not what approach to time is superior but how to navigate different notions of  
23 time once human actions puncture the Holocene and, with it, the possibility of parsing human  
24 from non-human time.  
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47 Chakrabarty's assertion of temporal rifts in Anthropocene time is not easy to defend.  
48 Coen (2016, p. 308) claims accepting incommensurability leaves us "paralyzed in the face of  
49 ethical questions that cannot be put off" and also doesn't account for the contingent, social  
50 aspects of spatial and temporal imaginations, which imply that there is no "fixed meaning to the  
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3 ‘human scale’ that could be set in opposition to ‘the planetary’.” In addition, Chakrabarty does  
4 not examine the configuration of time within Earth system science itself. It was the work of Ilya  
5 Prigogine on non-equilibrium systems that, to recall Schellnhuber (1999, p. C20), allowed the  
6 Earth system to be understood as a “single, complex, dissipative, dynamic entity, far from  
7 thermodynamic equilibrium.” Moreover, time was foundational to Prigogine’s work. For his  
8 account of time, he did not look only to physics but to the works of Bergson and Whitehead,  
9 among others (Prigogine and Stengers, 1984; Prigogine, 1997). In short, Prigogine entrained time  
10 into the physics of Earth system science in ways sophisticated and challenging, but not  
11 incommensurate with respect to human accounts of time. None of this implies Chakrabarty is  
12 wrong to identify challenges of time in the Anthropocene. It reveals, however, that moral  
13 geography must be attentive to how notions of belonging are often entangled with judgments  
14 about temporal categories—ontologies—across human and physical sciences.  
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33 (3) *Ontology*. Central to many appraisals of the Anthropocene is the rejection of fixed or  
34 transcendental categories of being and relations. A common aim is to exorcise dualisms between  
35 society and nature and to dethrone human exceptionalism (Braun and Whatmore, 2010). Once on  
36 flat ontological footing with other beings, forces, and processes, the agency of humans and non-  
37 humans provide scope for new, immanent forms of belonging (Coole and Frost, 2010; Tsing et  
38 al., 2017). Before considering these, one exemplar of why ontology matters morally can be  
39 highlighted in uptake of object-oriented ontology (OOO) in geography. OOO is a realist view  
40 that takes Kantian gap between things and their phenomenal appearance to human subjects and  
41 generalizes it to all objects (Harman, 2013). Morton (2013) employs OOO to argue that the  
42 Anthropocene is marked by hyperobjects, like plastics and climate change, that are so vastly  
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3 distributed in space and time that they are incommensurate with the subject-object correlation  
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5 through which phenomena are experienced. Hyperobjects are real entities that cannot be known  
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7 directly, a trait they share with all objects in OOO, the truths about which are allusive and only  
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9 indirectly known (Harman, 2013). Morton (2010, p. 127; 2017) argues that, as a consequence of  
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11 thinking without nature and without the Kantian subject, morality must be oriented to  
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15 “collectivity, not community.”  
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19 Mitchell (2015) applies OOO to locate the Anthropocene mismatch between moral act  
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21 and moral responsibility in a hyperobject: plastic. Plastics, on Mitchell’s account, are geological  
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23 markers of human impacts on the planet that transgress liberal, cosmopolitan norms that imagine  
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25 the moral community as a ‘circle’ that delineates those within as deserving of moral  
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27 consideration and what is outside as morally relevant only with respect to those within it.  
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29 Plastics, for Mitchell (2015), outpace liberal cosmopolitanism because they create relations and  
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31 harms of such scope and duration that there is no place ‘outside’ the moral circle; no  
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33 counterfactual ‘nature’ is available for circumscribing the moral community. Once plastics are  
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35 distributed throughout terrestrial and marine ecosystems, and insinuated into the bodies of  
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37 multiple species, the limits of modernity’s encircled moral geography are exposed. As a  
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39 hyperobject, the harms of plastic undermine the imagined moral geography of liberal,  
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41 cosmopolitan ethics and trespass its presumed boundaries of moral consideration. The upshot is  
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43 that the new ontological class of harms created by plastics requires an alternate account of moral  
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45 obligations. The upshot is  
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47 that the new ontological class of harms created by plastics requires an alternate account of moral  
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3 Mitchell (2015) makes several undefended moves, some of which are tied to deeper  
4 problems with OOO. First, if hyperobjects exist and are morally relevant then we are owed an  
5 account of the moral truths entailed by them. Yet, as with other truths in OOO, these would be  
6 allusive and indirect. Such truths provide little guidance for action.<sup>4</sup> Second, OOO's claim of  
7 incommensurability between objects and experience is suspect. Rejecting the Kantian subject  
8 does not warrant claims about humanity writ large. Many Indigenous communities have notions  
9 of subjectivity with (more than) sufficient resources to situate two and half centuries of  
10 anthropogenic climate change—a reputed hyperobject—in their moral communities (Watt-  
11 Cloutier, 2015; Whyte, 2017). So do western societies. If the goods plastic provides can be  
12 situated in our experiences, such as in packaging for emergency food, water, or medicine, then  
13 why not harms? As Masco (2015) shows, nuclear fallout is already socially placed in the moral  
14 imagination of the United States. So, even though nuclear fallout meets the criteria of a  
15 hyperobject (Masco doesn't treat it this way), it is not the 'thing' that renders it incommensurable  
16 but an ontological commitment that may or may not reflect social or cultural practices,  
17 imaginations, or categories.

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40 (4) *Agency*. Where is agency in the Anthropocene? Slugs, plastics, and hydrological processes  
41 are just a few non-human agents in the work of critical scholars that reference Latour's (1993)  
42 arguments that 'things' act in ways that refuse the society/nature binary.<sup>5</sup> Latour himself,  
43 however, rejects critical scholarship. Instead of establishing critical distance by showing how  
44 'matters of fact' depend on actions of both humans and non-humans, Latour (2004) pursues  
45 empiricism to get 'closer' to how scientific facts and the things that affect them together produce  
46 matters of concern. For Latour (2017), this entails that morality cannot be projected against  
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3 'nature' in the Anthropocene but must reckon with how agency is distributed by multiple human  
4 and non-human actants. Here, Latour (2017) mobilizes Lovelock's Gaia Hypothesis of Earth as a  
5 self-organizing system. Far from a stable site to reconvene 'nature' under even a provisional  
6 holism, Latour's Gaia emerges much as Stengers (2017) also envisions: a cacophony of agents,  
7 forces, and processes that have only misaligned, if any, ends. With this notion of Gaia in hand,  
8 Latour (2014, 2017) contrasts his much-maligned 'moderns' with those he calls earthbound. To  
9 be earthbound, Latour argues, is to reckon the distributed agency of Gaia. The  
10 modern/earthbound contrast provides the basis of, and a foil for, a new moral geography.  
11 Following Sloterdijk (2014), Latour argues that earthbound individuals do not (as do moderns)  
12 seek immunity from nature on the 'other' side of the society/nature binary. Instead, the  
13 earthbound face Gaia's gifts, uncertainties, and dangers. Latour then appeals to Schmitt's (2007)  
14 distinction between friends and enemies as the normative basis for politics to argue that because  
15 'moderns' constituted themselves without respect to Gaia there has never been an ecological  
16 politics. Now, however, 'moderns' are confronted by 'earthbound' enemies who reject consensus  
17 on the society/nature binary and demand land and territory for themselves (Latour, 2015)—an  
18 earthbound moral geography.

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42 Latour's (2017) claim that 'moderns' had non-ecological politics ignores violent  
43 geographies of modernity. The proposed Anthropocene start date of 1610—marked by the  
44 "Orbis spike" of carbon sequestration that attended biomass regrowth in the Americas after  
45 millions of Indigenous peoples were killed through diseases and warfare—is just one piece of  
46 evidence (Lewis and Maslin 2018). As Davis and Todd (2017) argue, a defensible ethical  
47 position in the Anthropocene must confront colonial violence against Indigenous peoples. So,  
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3 when Latour (2017, p. 13) claims “there is no cure for the condition of belonging to the world”  
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5 that may be true. But an account of belonging cannot ignore the modern, often violent  
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7 coproduction of territory and ecology itself (Anker, 2001) or the genealogies of colonial thought  
8  
9 that anticipate the Anthropocene (Bonneuil and Fressoz, 2016). Even if we accept Latour’s  
10  
11 peculiar Gaia for the sake of argument, an evolutionary account would still distribute agency  
12  
13 more widely across socio-cultural practices than what some moderns ‘discover’ as the basis for  
14  
15 being earthbound (see Kohn, 2013). There are sympathetic engagements with Latour that seek to  
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17 bridge between the worlds of the moderns and ‘others’ (e.g. Cadena, 2015). Nevertheless, the  
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19 onus remains on Latour to give an account that reckons not only with Gaia, but also with the  
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21 moral violence that his newly christened ‘earthbound’ agents are premised upon.  
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29         There are more lines of inquiry into belonging in the Anthropocene than those of novelty,  
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31 time, ontology, and agency. Malm (2017), for instance, rejects many of the positions advanced  
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33 above for a Marxist realism that retains the society/nature binary. What Malm’s polemic shares  
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35 with others, however, is an analytical target to the side of practices already taking shape without  
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37 nature or naturalized ‘others.’ The forms of belonging considered below accept the need to  
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39 grapple with novelty, temporality, ontology, and multiple human and non-human forces. In short,  
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41 they accept many of the points critical scholars of the Anthropocene make and are using them to  
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43 shift practices and norms of belonging in global sustainability.  
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### 49 3 THE TECHNOSPHERE, *GRUNDNORM*, AND GOALS

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3 Earth system science is already being used to shift norms of sustainability and to shape new  
4 forms of belonging in the Anthropocene. This section examines two such cases. The first is the  
5 treatment of humanity's life support apparatus as a technosphere; a geologic sphere like any  
6 other (i.e. the hydrosphere, atmosphere, lithosphere, or biosphere). The second is the return of  
7 Kantian ethics via a *grundnorm* that uses planetary boundaries for the Earth system to ground  
8 international law and notions of 'governing through goals.' Whereas critical scholars counter  
9 forms of naturalization with new lines of inquiry, new practices of belonging in the  
10 Anthropocene suggest a new politics of naturalization that leverages the end of 'nature' into new  
11 descriptions, norms, and ways of thinking; into a moral geography of the Earth system.  
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### 26 3.1 The Technosphere

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31 Hannah Arendt (1958) once remarked that, from the perspective of the universe, automobiles  
32 might look like a biological mutation in which humans develop steel shells. Echoing attempts to  
33 take this Archimedean view, Earth system scientists, including members of the Anthropocene  
34 Working Group such as Peter Haff (2014, p. 302), have treated the technological apparatus that  
35 supports human life as a technosphere in order to gain a more "detached view of an emerging  
36 geological process that has entrained humans as essential components that support its dynamics."  
37 According to Haff (2014, p. 302), the technosphere enables one to "adopt a non-anthropocentric  
38 view that technology is a global phenomenon that follows its own dynamics, representing  
39 something truly new in the world – the opening phase of a new paradigm of Earth history. In this  
40 sense, one might say that technology is the next biology."  
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3 The technosphere should not be placed on a spectrum between the eco-modernist embrace of  
4 technology (Schellenberger and Nordhaus, 2011), the reputed ‘good Anthropocene’ (Dalby,  
5 2016), or appeals to abandon technological mastery for an ‘ecozoic’ view of mutually enhancing  
6 human-Earth relationships (Berry, 1999). Rather, the technosphere is premised on treating  
7 humanity’s technological apparatus geologically. Haff (2014, p. 301) provides a definition worth  
8 quoting at length:  
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19 “The proliferation of technology across the globe defines the technosphere – the set of  
20 large-scale networked technologies that underlie and make possible rapid extraction from  
21 the Earth of large quantities of free energy and subsequent power generation, long-  
22 distance, nearly instantaneous communication, rapid long-distance energy and mass  
23 transport, the existence and operation of modern governmental and other bureaucracies,  
24 high-intensity industrial and manufacturing operations including regional, continental and  
25 global distribution of food and other goods, and a myriad additional ‘artificial’ or ‘non-  
26 natural’ processes without which modern civilization and its present  $7 \times 10^9$  human  
27 constituents could not exist.”  
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42 For Haff (2014), humans are to the technosphere what water is to the hydrosphere—part  
43 of a physical system. Along with other members of Anthropocene Working Group, Haff  
44 contributed to special issues of the journal *The Anthropocene Review* that mapped the spatial  
45 area and physical extent of the technosphere. According to the calculations of Zalasiewicz et al.  
46 (2017), the technosphere tips the scales at 30 trillion tonnes of cement, steel, reservoirs,  
47 farmland, and resources trawled from the sea floor, all of which support a human enterprise that  
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3 demands 81.83(10<sup>6</sup>) km<sup>2</sup> of urban and rural space. Such calculations enable the technosphere to  
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5 be measured alongside other geologic spheres and allows for the study of possibilities for  
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7 affecting its behaviour as one might another physical system. In addition to the implications of  
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9 configuring the human geography of the Earth system in this version of non-anthropocentrism, it  
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11 is notable that the technosphere is not ‘immunized’ from other geologic spheres but rather  
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13 integrated with them.  
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19           The reception of the technosphere has not been uniformly positive. While some apply it  
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21 to urban studies or inter-planetary arguments (Otter, 2017; Szerszynski, 2017), others identify  
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23 challenges. Donges et al. (2017) argue Haff’s conception of the technosphere restricts human  
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25 agency and intention in ways counterproductive to understanding the coevolutionary dynamics  
26  
27 of humans and non-humans, and that it ignores the peopled, political discourses of sustainability.  
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29 In short, the technosphere is a physical system, but it is not only physical. Incidentally,  
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31 responding to this objection can illuminate how the technosphere evades critiques of universal  
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33 notions of ‘the human’ in Earth system science. To the contrary, the technosphere appraises  
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35 human *capacities* for affecting the Earth system as one would other geological systems, where  
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37 the capacities (or affordances) of complex systems have long replaced essentialist ideas of  
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39 nature. Focus on capacities, it may be argued, provides scope for ascertaining the physical  
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41 possibilities of sustainability without undercutting the politics or agency of how those  
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43 possibilities are subsequently navigated. This rejoinder, however, has moral implications. As  
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45 Carruth and Marzec (2014) argue, measurement tools and instrumental interpretations are not  
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47 free of judgments. Other theorists are more dismissive, arguing the “unruly technosphere  
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49 responsible for the Anthropocene” is immoral because it configures machine-driven forms of  
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3 industrialism with information-driven networks of capital accumulation (Pasquinelli, 2017, p.  
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10 Provocatively, Haff's (2017) subsequent development of the technosphere mutes several  
11 lines of criticism by accepting the point that the intentions of human agents are at risk in the  
12 technosphere. Arguing that the global population is dependent on the technosphere, Haff (2017)  
13 claims that, from a geological perspective, the concern is that the technosphere might seek  
14 efficiencies that coopt or constrain human activity, such as through algorithms designed to  
15 pursue efficiency but to which human well-being is incidental. Haff (2017, p. 108) worries that  
16 not only may humans overwhelm the forces of nature but that humans may be "...in the process  
17 themselves of being overwhelmed by novel forces of an evolving earth." Advances in synthetic  
18 biology and nanotechnology, as Preston (2018) argues, create new moral terrain at scales that  
19 exceed many standard treatments of ethical action. Indeed, agreeing with critical appraisals of  
20 the Anthropocene, Haff (2017) grants it is irrational to treat humans as exceptional. Yet, he  
21 doesn't think this is grounds for rejecting human exceptionalism; instead, Haff (2017) celebrates  
22 irrationality and advances it as a basis for confronting dehumanizing forces of the technosphere.  
23 The danger of not doing so, he argues, is that geological processes may diminish humanity's  
24 "own status as essential components of an efficiency-driven technosphere" (Haff, 2017, p. 108).  
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47 Viewed through the technosphere, the moral geography of the Earth system naturalizes  
48 interconnections of energy, information, and materials. Recently, Lenton and Latour (2018) have  
49 argued the technosphere is part of a new Gaia—Gaia 2.0—that operates with some level of self-  
50 awareness owing to how humans can set planetary goals with the weight of geologic force  
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3 behind them. Setting aside that this seems more a reboot of the noösphere,<sup>6</sup> it is worth  
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5 considering Lenton and Latour's (2018, p. 1068) ethical conclusion, that "any attempt to tamper  
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7 with the sensors or slow down the reaction to errors jeopardizes the chance to learn from Gaia  
8  
9 how to close the loops that would enable Gaia 2.0 to better sustain the human population than the  
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11 present world." Here, Latour makes good on his effort to get 'closer' to the facts through  
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13 empiricism, but to do so he naturalizes the technosphere. Technology does not come from  
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15 nowhere. Its components are mined, refined, assembled, exchanged, and maintained through  
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17 relationships, social structures, and political economies that may justifiably prompt moral  
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19 responses of slowdown or stoppage. Such power blind techno-ethics, like Haff's embrace of  
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21 irrationality, do not suffice as moral reasons. As the next section considers, this is also not the  
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23 route being developed in Earth system governance, where new forms of rationality buttress goals  
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25 for belonging.  
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### 33 *3.2 Grundnorms and Goals*

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38 The technosphere treats the human enterprise geologically, but how might that conglomerate be  
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40 steered? This question is increasingly answered in Earth system governance in reference to  
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42 'governing through goals.' Goals augment the contingencies and uncertainties of deep time with  
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44 time-bound, metric driven agendas, such as the SDGs (see Kanie and Biermann, 2017). Goals  
45  
46 also shift sustainability from norms focused on 'setting the rules' for markets designed to provide  
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48 environmental relief—so-called 'green' neoliberalism (Bakker, 2010)—and instead direct  
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50 economic activity towards chosen, revisable ends (Young, 2017). As Dryzek (2016) argues,  
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53 Anthropocene institutions require reflexivity across market, non-market, and Earth system  
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3 feedbacks. Goals steer an already integrated economic and environmental system in two respects  
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5 that structure this section. First, goals are increasingly referenced to the planetary boundaries of  
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7 the Earth system and naturalized according to a *grundnorm*: a norm basic to all others. Second,  
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9 goals are used to interpolate empirical claims regarding the ‘safe operating space’ provided by  
10  
11 the planetary boundaries framework into normative constraints on human development (see  
12  
13 Rockström et al., 2009). Together, *grundnorms* and goals naturalize human-Earth integration as  
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15 empirical fact, not normative aim, and employ planetary boundaries to provide an empirical and  
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17 rational basis for new practices of belonging.  
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24 Kelsen’s (1945) positive legal theory held that law is a system of rules set between  
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26 normative validity, on the one hand, and empirical facts on the other. This formulation, like  
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28 others that operate ‘between facts and norms’ in the Kantian tradition, seek a non-metaphysical  
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30 foundation for rational validity and political legitimacy (Habermas, 1996). Whereas Habermas  
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32 (1996) sought this basis in empirical facts regarding communicative rationality and the reputed  
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34 power of the better argument, scholars of environmental law turn towards empirical accounts of  
35  
36 the Earth system. Here, Kelsen’s notion of a *grundnorm* is given empirical expression through  
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38 facts about the function and trajectory of the Earth system as it is disclosed through Earth system  
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40 science (e.g. Rockström et al., 2009; Steffen et al., 2018). This maintains fidelity to the Kantian  
41  
42 tradition but replaces Habermas’ notion of a community of truth seekers—where norms are  
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44 derived from rational consensus achieved by overcoming social or political difference—with  
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46 norms rationally derived from the state of the Earth system.  
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3 Kim and Bosselmann (2013) provide one of the most robust arguments for deriving a  
4 *grundnorm* from planetary boundaries. The planetary boundaries framework, on this account,  
5  
6 provides a basis for international environmental agreements because anthropogenic projects that  
7  
8 do not respect planetary boundaries with respect to freshwater, climate, or any of the nine  
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10 interacting components of the Earth system, will (ultimately) fail empirically. Well before that,  
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12 they will reveal the irrationality of agreements that are not premised on how the Earth system  
13  
14 functions. As a *grundnorm*, the planetary boundaries framework offers a rational and empirical  
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16 basis of normative validity without metaphysical or culturally specific appeals to 'nature.' Kim  
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18 (2016) argues such a *grundnorm* should also be incorporated into multilateral frameworks, such  
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20 as those regarding the SDGs, in order to meet both social and environmental obligations. For  
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22 Brandi (2015), there is an ethical imperative to establish an SDG for the Earth system since its  
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24 functioning provides the basis for achieving all of the others. Hayha et al. (2016) develop a  
25  
26 similar idea, arguing that in order to connect the SDGs to the Earth system it is imperative to  
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28 incorporate ethics as a distinct sphere of decision making. In their account, moral judgments  
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30 come in a sequence that begins with biophysical determinations of the Earth system before  
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32 moving to assessments of socio-economic connections across scales and sectors of planetary  
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34 dynamics. Then, in a third step, ethical principles are applied to achieve equity and justice. In  
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36 short: with the Earth system as a *grundnorm*, and the facts of socio-political connections between  
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38 people and planet in hand, moral geography finds a hierarchy not naturalized to nature, but to the  
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40 how Earth system science discloses human-Earth integration.  
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51 One challenge for Earth system governance and sustainability is to operationalize the  
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53 notion of ecological integrity that underpins planetary boundaries at the scale of the Earth system  
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3 (Kim and Bosselmann, 2015). To this end, the novel use of “goal-setting” by the United Nations,  
4 such as in the SDGs, provides opportunity to incorporate empirical facts about human-Earth  
5 integration into political and economic agendas (Biermann et al., 2017; cf. Biermann 2014). This  
6 might be done by, for instance, down-scaling from the Earth system and up-scaling from human  
7 needs to calculate a “a good life within planetary boundaries” (O’Neill et al., 2018). When goals  
8 are used for governance, they contrast with the rule-based norms of neoliberalism in earlier  
9 iterations of sustainable development, where states were expected to set the rules for markets and  
10 stakeholders, and where normative legitimacy arose from fair procedures and institutions for  
11 economic and political allocation of resources (Young, 2017). In place of rules putatively  
12 designed for free competition, goals become sites where uncertainty and complexity provide  
13 warrant to actively steer intractably entangled political and economic processes (Kanie and  
14 Biermann, 2017).

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33 The aim of ‘governing through goals’ is not to integrate ‘many worlds’ to one Earth.  
34 Instead, the fact of integration means that previous norms of sustainability, such as the rules for  
35 reregulating markets under earlier programs of sustainable development, must be fortified by  
36 actively directing economies and polities to stay within the constraints of the Earth system. The  
37 temporal horizons of political goals, such as the 2030 SDGs, may be arbitrary from the  
38 perspective of the planet, but in the context of existential risks to human flourishing they entail  
39 ethical value assessments about possible futures (cf. Bostrom, 2013). These are judgments at the  
40 intersection of economics and environments that don’t naturalize moral orders to natural ones.  
41 Instead, they project a hierarchical order of normative integration (a *grundnorm* at the base of all  
42 others) onto a non-hierarchical Earth system that is characterized by cross-scale feedbacks and  
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3 non-linear dynamics (Steffen et al., 2004, 2018). As with the technosphere, this is a politics of  
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5 naturalization that proceeds through the means of doing without nature.  
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#### 10 4 NEOLIBERALISM WITHOUT NATURE

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14 Why emphasize the moral geography of the Earth system, not that of the Anthropocene? In part,  
15 this distinction highlights that there are more than just metaethical stakes about how to think  
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17 about the epoch as a whole. A broader concern, however, is how the loss of ‘others’ affects new  
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19 forms of belonging (cf. Elliott, 2018). In this regard, the technosphere, a *grundnorm*, and goals  
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21 perform naturalizing work that does not truck in natural laws or transcendent categories. They  
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23 immanently render new descriptions of a physical system, new norms upon which to proceed,  
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25 and new ways to think about the moral ends of governance; a moral geography of the Earth  
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27 system. Examining these practices requires tools moral geography can offer, and which can  
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29 identify a new politics of naturalization taking shape. This politics begins with human-Earth  
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31 integration as an accomplished event, albeit not on the terms of sustainable development where  
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33 market forces were dispatched to meet the needs of one generation without compromising the  
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35 ability of future generations to meet their own needs. Rather, the new politics of naturalization  
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37 anticipates a form of neoliberalism without nature; a neoliberalism that retains the structure of  
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39 sustainable development but sheds the assumption that nature provides a stable backdrop for  
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41 fulfilling human needs from one generation to the next.  
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51 The idea of the Earth system reinforces the place of ‘system’ as a—possibly the—master  
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53 modality for knowledge in modernity (cf. Siskin, 2016). The Earth system operates, in this sense,  
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3 as explanandum and explanans: a way to describe phenomena to be explained and a way to order  
4 the knowledge explaining those phenomena. Yet it doesn't naturalize phenomena to an external  
5 'order of nature.' Instead, it is used to moralize the means of doing without nature. To recall: the  
6 moral imperative is to not hinder the technological means through which Gaia 2.0 is known  
7 (Lenton and Latour, 2018), while a *grundnorm* frames empirical possibilities for the good life  
8 even though frames are not reasons (Hale, 2016). Likewise, using 'goals' to correct for the limits  
9 of neoliberal integration of economics and environment under sustainable development  
10 anticipates forms of belonging after the end of (western) nature. Neoliberal structures of  
11 governance, however, are left in place on such accounts when the political economy of the  
12 technosphere vanishes, or when a *grundnorm* is advanced without reparation for the uneven  
13 geographies now pressing planetary boundaries. Neoliberalism without nature is consistent with,  
14 but not yet considered in, accounts of neoliberalism (e.g. McCarthy and Prudham, 2004).  
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33 Neoliberalism without nature has been gestured at in accounts of: the rise of neoliberal  
34 governmentality alongside the incorporation of resilience and complex systems theory in finance  
35 and valuation (Cooper, 2011; Walker and Cooper, 2011; Chiapello, 2015), the integrated, 'causal  
36 architecture' connecting environmental and economic crises (Homer-Dixon et al., 2015), and the  
37 "naturalization of process" that connects geologic agency to liberal modes of environmental  
38 governance and sustainability (Schmidt, 2017, p. 197). Here I do not seek to unpack what  
39 neoliberalism without nature entails, but to name a phenomenon that a renewed moral geography  
40 can identify in combinations of descriptive, normative, and metaethical claims now taking shape  
41 in accounts of human impacts on the Earth system. The use of planetary boundaries to set goals  
42 that direct international financial practices, such as the 2030 SDGs, provides a non-contingent  
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3 timeline for resource valuation and risk calculation without nature and amidst uncertainties over  
4 human impacts on the planet (e.g. Sachs, 2015). Perhaps most striking, however, is the moral act  
5 of calling for value transformation. Such calls demand an account of the moral geography of the  
6 Earth system that underpins them, especially given that calls for transformation are themselves  
7 premised on values, such as planetary stewardship, that have long been used by actors in the  
8 Global North to describe biological and geological resources of the Global South as of 'world'  
9 significance and to then justify political intervention and (often) capital accumulation (Macekura,  
10 2015; Black, 2018). Sustainability has never been value-neutral. Calls for value transformation  
11 structured in global programs of neoliberalism without nature also sharpen contrasts with non-  
12 systemic, relational forms of life underpinning other socio-cultural forms of life that merit  
13 dignity. And they do so at a critical moment: when decisions taken will affect the trajectory of  
14 social and Earth system evolution for millennia.  
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33 There is currently a missing account of how forms of belonging are being shaped as  
34 sustainability works without nature yet retains the form of integration achieved under  
35 neoliberalism. Renewing moral geography in this context provides opportunity to examine forms  
36 of belonging taking shape without nature or naturalized 'others.' It can identify naturalizing  
37 impulses in both transcendental and immanent accounts of belonging. A renewed moral  
38 geography must retain its orientation to difference and its commitment not to impose external  
39 categories of description, norms, or metaethical concepts on social practices. This pluralistic  
40 approach can and should, however, also be trained on new politics of naturalization in which  
41 belonging proceeds both with or (through the means of doing) without nature. This requires  
42 renewing commitments across geographic scholarship, such as in fields engaged with science  
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3 and technology studies or social studies of finance. The moral dimensions of these fields are  
4 frequently implied, yet often not explicitly engaged across descriptive, normative, or metaethical  
5 concerns. Likewise, geographic work on human-environment relations, global change research,  
6 and global governance might expand from recognition that the Earth system is too complex to  
7 govern *in toto* and examine how accounts of human-Earth integration developed in light of this  
8 fact—as a physical system, in reference to planetary boundaries, as a basis for goals—are  
9 shaping calls for value transformation and shifting the norms of sustainability in the  
10 Anthropocene.  
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## 24 **Acknowledgements**

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## 28 **Footnotes**

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31 1. Moral geography, for its part, often only indirectly engages the Anthropocene. See Olson's  
32 (2018) progress reports.  
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38 2. Baker (1999), for example, engages geology through the semiotics of Charles Peirce.  
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41  
42 3. Hornborg (2017) makes similar critiques of Haraway (2016), Tsing (2015), and Moore (2015).  
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47 4. It is unclear if adherents of OOO are also metanormative realists who hold that moral truths  
48 exist independently (Enoch 2010). If so, an account of those allusive truths is also required.  
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54 5. Respectively: Ginn (2014), Mitchell (2015), Lorimer and Driessen (2014).  
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5 6. Teilhard de Chardin's notion of the noösphere explains consciousness in bio-evolutionary  
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7 terms to suggest self-awareness is a new step in planetary evolution (see Sideris, 2017).  
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9  
10 Arguably, Lenton and Latour (2018) reboot the idea with technology rather than only biology  
11  
12 affecting evolutionary self-awareness.  
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