

16 The Anthropocene: an opportunity for  
transdisciplinary and inclusive science?

*Andrea L. Balbo, Delf Rothe, and Jürgen Scheffran*

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# **Climate Change, Security Risks, and Violent Conflicts**

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in Hamburg

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# 16 The Anthropocene: an opportunity for transdisciplinary and inclusive science?

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Andrea L. Balbo, Delf Rothe, and Jürgen Scheffran

## Abstract

*The informal understanding of the Anthropocene has sparked a significant worldwide debate across disciplines, including cultural studies, arts, literature, philosophy, law, sociology, political science, and international relations. Beyond its geological and chronological formalization, the Anthropocene is being discussed as a “new planetary real”, a state shift in the Earth system, where humanity becomes aware of the role of collective human agency as the primary planet-transforming factor, with dramatic ecological, social, and economic implications. As such, the Anthropocene debate offers a unique opportunity to address limitations of established divides between academic communities and of their representativeness in issues involving science and society. Obvious imbalances in terms of disciplinary, ethnic, and gender inclusiveness emerge from the review of the composition of the Anthropocene Working Group, in spite of improvements over its predecessor, the Holocene Working Group. A strong polarization between the Earth and Natural Sciences on one side and the Humanities and Social Sciences on the other also emerges from the analysis of term co-occurrence in scientific publications mentioning the word “Anthropocene”. Based on these findings, we draw some propositions for the development of a transdisciplinary and sustainable anthropocene science, embracing inclusiveness, openness, curiosity, and knowledge sharing.*

KEYWORDS: Science, knowledge, epistemology, transdisciplinarity, inclusiveness.

## Introduction: Towards a formalization of the Anthropocene

On 29 August 2016, after seven years of work, the Anthropocene Working Group (AWG) officially proposed to formalize the Anthropocene as the most recent geological epoch of planet Earth at the 35th Congress of the International Union of Geological Sciences (IUGS) in Cape Town, South Africa. With only one exception, the 37 AWG members decided that there was sufficient stratigraphic evidence for the Anthropocene epoch to replace the Holocene, the interglacial period previously defined by the Holocene Working Group (HWG), beginning approximately 11,700 years before AD 2000, as ratified in May 2008 (Walker et al. 2009). The AWG recommendations are part of an ongoing debate, mostly contained within the Earth and Natural Sciences (ENS), on the pros and cons of a formalization of the Anthropocene as a geological epoch and on its start date (Ruddiman et al. 2015).

Formalizing the Anthropocene is justified by the recognition that human activities have now profoundly altered geologically significant conditions and processes at the planetary level (Waters et al. 2014, Waters et al. 2016). Accepting this claim implies officially recognizing the end of the Holocene, and defining a clear chronological boundary between the two epochs. The AWG proposes the world's first explosion of an atomic bomb on July 16, 1945 at Alamogordo, New Mexico, as the "stratigraphically optimal" marker for the beginning of the Anthropocene (Zalasiewicz et al. 2015). Anthropocene deposits are therefore those lying above this globally distributed primary artificial radionuclide signal. Competing proposals for an earlier beginning of the Anthropocene, in prehistory, following the Neolithic agricultural expansion (Ruddiman 2003, Fuller et al. 2011), or during the industrial revolution (Zalasiewicz et al. 2015, Steffen, Crutzen, and McNeill 2007), were excluded for lack of a comparably defined "golden spike" (Ellis et al. 2016).

The following discussion of this perspective follows a debate held on September 22–24, 2011 at the International Symposium "Limits to the Anthropocene", chaired by Paul Crutzen at Universität Hamburg. The focus here is on the limits of Anthropocene science and the state of knowledge integration between the Earth and Natural Sciences (ENS) on the one hand and the Humanities and Social Sciences (HSS) on the other. Thus, this piece provides a sample of one of the characterizing traits of the CLISEC network over the past decade, namely its efforts towards the integration of expertise from the ENS and HSS to explore linkages between climate change and security.

Our analysis of the composition of two IUGS working groups (the Holocene WG and the Anthropocene WG) finds an opening of the scientific community coupled with the acknowledgement of an epistemological shift from pure ENS towards the inclusion of HSS. Yet, bibliometric analysis of scientific publications on the Anthropocene suggests that the debate continues to be split and disjoint between these two



camps. The ENS, concerned with the formal definition of the Anthropocene; the HSS, concerned with the social, political and philosophical implications of human impact on the Earth system.

Nearly a decade after “Limits to the Anthropocene”, the Anthropocene concept provides an opportunity to transcend this schism. Acknowledging the transformative implications of this new epoch, in which the boundaries between humanity and its natural environment collapse, is required for the emergence of a dedicated transdisciplinary and inclusive branch of science.

## Beyond the Earth and Natural Sciences

The Anthropocene debate has generated a scientific tension within the ENS but also between those disciplines and neighboring fields of knowledge. In fact, the recognition of collective human action as responsible for pushing the Earth system into a new state (Barnosky et al. 2012), questions the ability of the Earth and Natural Sciences to adequately define this new epoch without inputs from other disciplines (Chakrabarty 2009, Brondizio et al. 2016). Questions have arisen on how knowledge of the Anthropocene is produced, by whom and with which methods, and on how it is circulated and authorized (Baghel 2012, Lövbrand et al. 2015). Ultimately, the prominent role of human agency in the Anthropocene debate has attracted the attention of disciplines outside the ENS. This epistemological shift is reflected in the composition of the AWG, in comparison to the HWG (Figure 1).

While the HWG was composed of 17 members, the AWG has 37. While all HWG members proceeded from ENS (Quaternary Sciences, Geography, Geology, Climatology, Glaciology, Oceanography and Biology), the AWG includes 8 representatives of the Humanities and Social Sciences (HSS, namely History, Archaeology, Philosophy, Literature and Law). Members from European institutions are the majority in both groups, with 58 % representatives. In addition to European members, the HWG had 3 members from North America, 3 from Oceania (Australia and New Zealand) and 1 from Asia (Japan). The AWG in turn reflects a somewhat more global composition, with 10 members from North America, 1 from Oceania (Australia), 1 from Asia (China), 1 from South America (Brazil) and 2 from Africa (Kenya and South Africa). No women were included in the HWG, while the AWG comprises 7 (Figure 1). Overall, the AWG shows a more inclusive composition than the HWG, opening up interesting avenues for interdisciplinary cooperation between ENS and neighboring disciplines, as well as for gender and global diversity. Nevertheless, both working groups remain dominated by European and American members, and scientists from other continents, as well as members from the Humanities and Social Sciences (HSS) and female representatives, remain a minority (Raworth 2014).

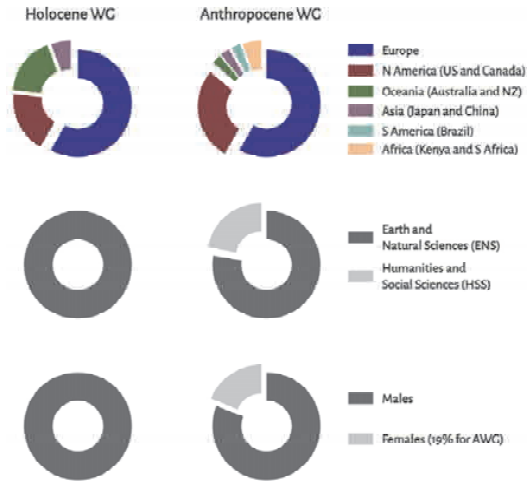


Figure 1: Holocene Working Group (HWG) compared to Anthropocene Working Group (AWG). *Note for B&W printing: Earliest related keywords are clustered on the left, latest on the right of the graph (as shown in legend).*

## Anthropocene or anthropocene?

The integrative potential of the Anthropocene debate is limited by the desire to formalize the epoch and by the demand of ENS scientists to defend established epistemological and methodological conventions. To allow for a broader disciplinary involvement, Ruddiman and others (2015: 39) suggested “[...] to use the term informally (with a small a)”. In such terms, unlike previously defined geologic epochs, the anthropocene debate has escaped boundaries, resonating across disciplines, and challenging the traditional structure of academic knowledge and scientific thinking. As a result, two opposing discourses have emerged from the two major interpretations of the anthropocene – the formal geochronological definition with an upper-case “A” and the informal and more inclusive debate using anthropocene with a lower-case “a”. Besides isolated calls (Ellis et al. 2016, Brondizio et al. 2016, Castree 2017), little demand for cooperation and exchange between these two discursive fields seems to exist, not only due to a missing conceptual vocabulary but also due to diverging scientific paradigms and approaches (Belli 2016). In fact, the demand to formalize the Anthropocene in a stratigraphically robust way excludes most scholars in the HSS from the upper-case “A” debate. On the contrary, the anthropocene debate in the

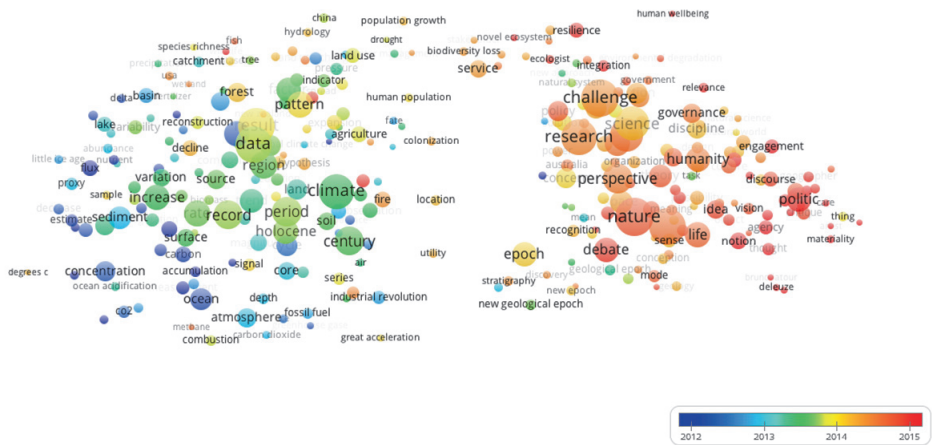


Figure 2: Co-occurrence analysis of keywords in the Anthropocene debate.

*Note: Terms represented with larger circles appear more often and the proximity between terms is given by their co-occurrence within the same article. Keyword co-occurrence was elaborated for a total of 1416 papers included in the Web of Science database (as to 14th of March 2017) that contain the word “anthropocene” in the title or abstract, conducted in VOSViewer (van Eck and Waltman 2014). Note for B&W printing: Earliest related keywords are clustered on the left, latest on the right of the graph (as shown in legend).*

HSS has taken up a vibrant life of its own. The HSS will continue discussing the anthropocene as a theoretical or philosophical concept – independent of the question of whether or not it will be formalized as a new geological epoch.

This divide is illustrated in Figure 2, showing the co-occurrence of the most relevant terms appearing in titles and abstracts of scientific papers mentioning the word “Anthropocene”. The emergence of two clusters of keywords indicates two clearly defined epistemological approaches. The cluster on the left side of Figure 2 includes core concepts and keywords of the upper-case Anthropocene debate, a scientific discourse dominated by the ENS and structured around such terms as “Holocene”, “climate”, “CO<sub>2</sub>”, “sensitivity”, “trend”, “data”, “pattern”, or “indicator”. On the contrary, the keyword cluster on the right side includes keywords and concepts that are commonly used in the lower-case anthropocene debate, dominated by the HSS and engaging the anthropocene as a “concept”, “narrative”, “challenge”, “discourse”, or “debate”. This is a more reflexive discourse, focusing on the anthropocene as a new “perspective” on “humanity” and its relation to “nature”. This cluster also includes the implications of the anthropocene concept for “politics” and “governance”, “resilience”, or “human well-being”.

Figure 2 illustrates the time-constrained development of keyword usage. It clearly demonstrates how the early Anthropocene debate was dominated by climate science (blue and green keywords on the left side). Early authors such as Crutzen and Stoermer (2000), for example, used the term Anthropocene to make a case for the severity of climate change. More recently, the Anthropocene debate within the ENS cluster has been directed toward the formal definition of the Anthropocene, as signaled by light-green, yellow and orange circles associated with keywords such as “Holocene”, “record”, “period”, “industrial revolution”, or “agriculture”. The cluster on the right clearly shows that the more reflexive anthropocene discourse of the HSS has set in more recently, between 2014 and 2015 (yellow, orange, and red circles). For example, recent works include investigating “politics” and “governance” in the anthropocene and assessments of their implications for global welfare, justice, or security (Hamilton, Gemenne and Bonneuil 2015, Biermann 2014, Dalby and O’Lear 2016).

### An opportunity for transdisciplinary and inclusive science?

In the anthropocene narrative, the transformative effect of collective human action is assimilated to that of large geological and climatic events, once perceived as gigantic and now dwarfed in the face of the realization of humans’ own impact on the Earth system. The idea that humanity has become a telluric force similar to volcanism or tectonic plate movements is so radical that it triggers considerable debates about the appropriateness of core ontological and epistemological assumptions, such as the clear demarcation between nature and culture found at the roots of Western philosophical thought (Hamilton et al. 2015, Dalby and O’Lear 2016). Present understandings of the complexity and interconnectedness emerging from the interaction of environmental and social phenomena are showing the limitations of traditional academic, disciplinary, and knowledge boundaries (Lüthje, Schäfer and Scheffran 2011). A collective and inclusive effort promoting the trespassing of disciplinary boundaries is necessary to study the complex network of actions, feedbacks, and interactions linking the different elements of the Earth system, including humans (Ellis et al. 2016). Such intellectual challenges imply inevitable structural changes from 20th century “ecology of science” (Lüthje et al. 2011). We thus look beyond the formal and narrow definition of the Anthropocene epoch, and reiterate the primary importance of a broader anthropocene discourse connecting citizens and scholars from different parts of the world, with different gender as well as cultural, educational, and disciplinary backgrounds.

This vision of the anthropocene debate is to provide a fertile test ground to define novel research practices based on experience from a broad number of knowledge

and scientific sectors. These novel research practices require a new “ethos of cooperation” and the development of a common, and richer, conceptual vocabulary that enables interdisciplinary cooperation (Brondizio et al. 2016). The “shock of the Anthropocene” (Bonneuil and Fressoz 2017) might be the necessary impulse to collapse the defensive walls erected by oppositional academic and non-academic fields. In this new theoretical space, HSS scientists would learn that humans and social systems could not be studied independently from the Earth system (Clark and Gunaratnam 2017). Social scientists need to confront the new dimension of “the planetary” when engaging concepts such as well-being, security, or justice (Brzoska et al. 2012; Hardt 2018; Rothe 2016). ENS scientists, on the contrary, need to acknowledge that the destiny of the Earth system in the Anthropocene is imbricated with understanding of the social and the political spheres as never before, in a complex reality that is not amenable to the principles of stratigraphy.

Finally, independent of the agreed formal start date, it will be crucial to recognize that the Anthropocene is the result of a long chain of cultural, social, and technological innovations, initiated thousands of years ago (Ellis et al. 2013, Ruddiman 2003, Ruddiman 2015). Without them, humanity would neither have been capable of changing planet Earth at the present scale, nor would it be aware of ongoing planetary changes, for our current knowledge of changes of the Earth system stems from a massive socio-technological assemblage of planetary dimensions, including, for example, weather satellites, in-situ sensors, computers, simulation models, or visualization algorithms. Just as the atmosphere, the lithosphere, the hydrosphere, or the biosphere, the “technosphere” should be seen as part of the present Earth system (Edwards 2017, Rosol, Nelson, and Renn 2017). This implies a completely new reality for academia, in which social and data scientists, tech start-ups, or commercial visualization specialists become essential actors in the production of sustainable scientific knowledge. Much work remains to be done to provide viable and fair perspectives for the future of humans and non-humans within the Earth system. Embracing the anthropocene debate stimulates inclusiveness, openness, curiosity, and knowledge sharing, all necessary qualities in the planning of collective human actions for the definition of our current and future relationship with planet Earth and beyond.

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