




# Creative destruction in academia: a time to reimagine practices in alignment with sustainability values

Emmy Wassénus<sup>1,2</sup> · Anne Charlotte Bunge<sup>1</sup>  · Mary K. Scheuermann<sup>1</sup> · Kajsa Resare Sahlin<sup>1</sup> · Agnes Pranindita<sup>1</sup> · Moa Ohlsson<sup>1</sup> · Abigayil Blandon<sup>1</sup> · Chandrakant Singh<sup>1</sup> · Kristin Malmcrona Friberg<sup>1,3</sup> · Patricia Villarrubia-Gómez<sup>1</sup>

Received: 14 December 2022 / Accepted: 16 May 2023 / Published online: 3 July 2023  
© The Author(s) 2023

## Abstract

Academia has experienced acceleration and expansion in parallel with the Great Acceleration, which has shaped the Anthropocene. Among other pressures, the expectation to be internationally mobile conflicts with many values held by sustainability scholars and results in disillusionment. The changes in the academic system can be seen through the framework of the adaptive cycle, which can help us understand historical parallels and shape the system to better align with sustainability values in future. We hope this piece can contribute to the discussion of the next steps forward to reimagine academia.

**Keywords** Sustainability science · Transformative research · Adaptive cycle · Creative destruction

## Drivers of acceleration

As we write this perspective piece, the Scripps Institution of Oceanography on Mauna Loa measures a global atmospheric carbon dioxide concentration of 421 ppm (parts per million). Global societies face the realities of climate change effects with an increase in temperatures of 1.2 °C relative to the pre-industrial levels (WMO 2022), and heading toward a +2.5° future by 2100 (UNFCCC 2022). Over the last decade, several regions experienced the driest and hottest summers on record, while others navigated unprecedented flash floods and record hurricane seasons. Europe has been identified as a hotspot for extreme heat waves (Rousi et al. 2022). Six out of nine planetary boundaries—the proposed scientific limits representing a safe biophysical operating space in which humanity can thrive and develop—have been crossed (Wang-Erlandsson et al. 2022). This has been driven by the

Great Acceleration of (mainly high income) human activities on the planet (Jouffray et al. 2020; Steffen et al. 2015); some even argue so much so that human activity is driving the sixth mass extinction (Ceballos et al. 2015). The state of emergency right now however is fuelled by a “rapidly closing window” (IPCC 2022) to change our course. There are 7 years left until the Paris Agreement is officially unmet (UNFCCC 2022), and the latest research only confirms and solidifies the potentially catastrophic consequences of passing 1.5 °C (Armstrong McKay et al. 2022).

At the same time, academia has also experienced an acceleration and expansion in its practices (Paasche and Österblom 2019). The expansion of aviation during the last 70 years has created the opportunity for long-distance travel at relative ease and low-cost. Consequently, academic travel and mobility for conferences, fieldwork and employment have proliferated (Bjørkdahl and Duharte 2022). The Internet has resulted in vast information flows surpassing the contents of physical libraries and journals. Academics today have an ever-growing stream of peer-reviewed papers coming their way (Larsen and Ins 2010), and it is argued that many are never read (Meho 2007). The COVID-19 pandemic increased demands on many researchers’ time, with one study showing a 5% reduction in accepting peer review requests (Dance 2023). The pandemic also exacerbated existing feelings of stress and burnout in academia, with one study showing greater impacts on women’s personal and professional workloads (Gewin 2021). Dissemination of research into society has also become one of the main

---

Handled by Jim Falk, The University of Melbourne, Australia.

✉ Anne Charlotte Bunge  
annecharlotte.bunge@su.se

<sup>1</sup> Stockholm Resilience Centre at Stockholm University, Stockholm, Sweden

<sup>2</sup> Global Economic Dynamics and the Biosphere, The Royal Swedish Academy of Sciences, Stockholm, Sweden

<sup>3</sup> Strategic Sustainability Studies, KTH Royal Institute of Technology, Stockholm, Sweden

tasks for academics, as part of our social contract with society (Lubchenco 1998). The internet revolution, science communication and the rise of social media have increased pressure on academics to not only conduct research but also disseminate it to the public frequently. This is particularly felt by younger, early-career academics such as ourselves, for whom social media have been present during a large part of our lives.

We are a group of ten early-career scientists at the Stockholm Resilience Centre pursuing doctoral degrees in sustainability science—the problem-driven and solution-oriented science addressing how to meet the current needs of people without risking those of future generations (Clark 2007) and with “commitment to moving [-] knowledge into societal action” (Kates 2011). All authors of this commentary are currently at the Stockholm Resilience Centre at Stockholm University in Sweden. Our doctoral education is grounded in concepts and theories from resilience and sustainability science at the Resilience Research School. At the same time, we bring our experiences of and conceptualizations of sustainability and academia gained in Asia, North America, and various parts of Europe to our current situation. The sustainability discourses in these diverse experiences contain multiple values that may cause tension with our different personal and professional identities. In this piece, we focus on our common identity as a group of early-career researchers living and working in the privileged context of a Northern European university setting, where we have developed our ideas in this piece through workshops and iterative discussions.

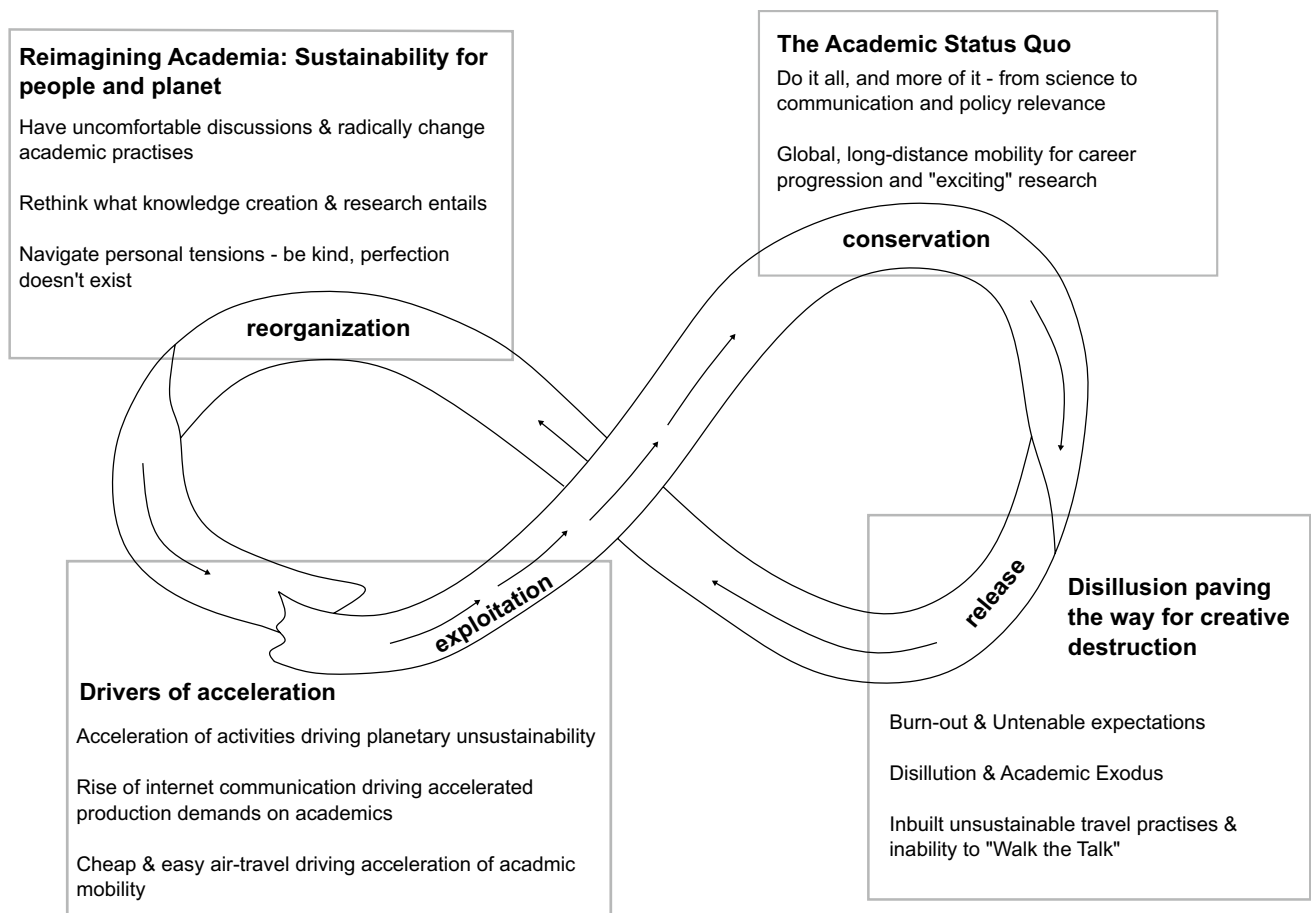
We argue in this commentary that academia today has solidified into a set of norms and practices directed by these drivers of acceleration, and that these norms and practices are misaligned with values held by us and many others. These values include living sustainably and within our planet’s boundaries; having working environments that promote and nurture personal well-being; equally distributing opportunities for advancement; and taking a broad perspective on the definition of knowledge. We are now at a critical point of creative destruction where we can dismantle existing practices and radically reimagine academia to align with our sustainability values. In this piece, we aim to contribute to the growing scientific discourse on the need to reimagine academia (Lazurko et al. 2020; Caniglia et al. 2021; Care et al. 2021; Sellberg et al. 2021). For this purpose, we draw upon the concept of the adaptive cycle, as a classic framework in resilience and sustainability research.

## Academia perched on the cusp between conservation and release

The concept of the adaptive cycle comes out of both ecology and economics. The original idea came from economics and the study of boom-and-bust cycles and the notion

that these cycles run through a period of “creative destruction” (Walker and Salt 2006). Ecologists have since documented and found that ecosystems all around the world go through four distinct phases: rapid growth, conservation, release, and reorganization (Gunderson and Holling 2002). The cycle starts with a period of rapid growth that transitions incrementally into a conservation phase. Growth is replaced with increases in connectivity and the system becomes more rigid. The system thus becomes increasingly stable, but only to a decreasing range of conditions. The conservation phase is then punctuated by a time of creative destruction, also called the release phase. In ecosystems, the release can be events such as fires or droughts, while in economics, it can be market shocks or crashes. The release phase is marked by uncertainty as the old system has collapsed, but no new one has been rebuilt yet. This uncertainty opens up for renewal and reorganization (Walker and Salt 2006).

We propose that the current trends in academia can be seen as phases of the adaptive cycle (Fig. 1) and that it is currently perched on the cusp between the conservation and the release phase, with some institutions and scholars already in the release or even reorganization phase. As of now, the academic system is increasingly entrenched in several unsustainable patterns. Routine travel has become the implicit and explicit norm, where attendance at conferences worldwide, overseas fieldwork, and the need for international mobility to secure academic positions are seen as given, especially as an early-career academic (Bilecen and Van Mol 2017; Köhler et al. 2022). A recent study in France found that a higher rate of air travel is associated with a higher publication rate and *h*-index, albeit using pre-pandemic data (Berné et al. 2022). There is also a reinforcement of the norm of the overachiever academic who is required to do it all; write multiple high-impact papers with many international collaborators, communicate them to the public in an impactful manner, and make them policy-relevant while being a liaison with stakeholders. This status quo is both unsustainable for the planet in a time when we need rapid phasing out of carbon-intensive activities, and unsustainable for people where the multiple demands are leaving academics overstretched (Paasche and Österblom 2019). The status quo has grown rigid, but only to a decreasing range of disturbances (Walker and Salt 2006). The system is currently shaken by the disruptions of the pandemic and the climate change crisis, and we should take these disruptions as a time of creative destruction. The release phase is marked by uncertainty as the old system has collapsed, but no new one has been rebuilt yet. Renewal and reorganization are thus possible, and the time for reimagining academia to align it with sustainability values is now.



**Fig. 1** Using the adaptive cycle to understand the drivers of acceleration, the academic status quo and the pivotal time right now to reimagine academia

## Disillusion paving the way for creative destruction

Academics are becoming increasingly disillusioned with the current academic status quo. Perhaps this is felt more acutely by young sustainability researchers (such as ourselves) with the tensions we perceive between sustainability values and current expectations for success in academia: avoiding burnout while securing a position; building networks while avoiding air travel; and expanding concepts of knowledge yet developing expertise and credibility in your field.

In the wake of the pandemic, high levels of stress and burnout have been revealed, especially in countries that experienced full lockdowns with the added task of childcare (Gewin 2021). It has been suggested that the pandemic was ‘the straw that broke the camel’s back’ in that it revealed the underlying systemic problems of the acceleration of academia. As PhD students, we feel this stress profoundly. With post-doc positions on the horizon, nearly every lunch conversation includes debates about taking the academic path of short-term contracts and often lower salaries, or changing

paths toward industry positions or other opportunities. Trends of “post-doc boycott” have been seen in the United States, where principal investigators struggle to get applications for their funded post-doc positions (Langin 2022). Although we enjoy conducting research and the opportunity it creates to contribute to society, the investment required to master an ever expanding range of skills and low job security are not appealing.

This disillusion stretches beyond the demands of research output. Increasing attention has been paid to the inherent contradiction of sustainability scientists with disproportionately large carbon footprints (Arsenault et al. 2019; Glover et al. 2017), calling out hypocrisy. Being early-career sustainability scientists, we would like to nuance this discussion in two ways. First, we feel this hypocrisy, or tension, in our everyday lives. We feel like we are being asked to choose between our future career progressions and ‘walking the talk’, that is, aligning professional and personal life with scientific evidence. With the status quo built up around avian hypermobility, how do you remain grounded to your sustainability values without losing academic ground to your peers? Second, this is not solely

a problem of hypocrisy within sustainability science but a problem of the inherent unsustainability of academic mobility norms at large. Different disciplines, including sustainability science, rack up large carbon footprints through conferences and fieldwork in far-off locations. Multiple universities are now making net-zero pledges (UNEP 2021), and all scientific disciplines will likely be affected in the near future.

The third mismatch that is gaining attention is the disillusionment over the narrow, exclusive view of knowledge prevalent in Western higher learning. The “fly-in-fly-out” style of research by academics from the Global North is still prevalent, whereby scientists acquire knowledge in far-away places without being situated in the context or knowing the language or culture. While some sustainability science scholars have highlighted the essence of respecting local knowledge since the field emerged as a discipline (Olsson and Folke 2001), there is still room to widen the scope of what knowledge is and how and by whom it is created within sustainability science and wider academia (Lazurko et al. 2020). This issue is starting to gain increased attention through studies on Traditional Ecological Knowledge (Lam et al. 2020), knowledge co-production (Chambers et al. 2021; Norström et al. 2020), and increased calls for the view of decolonization and intersectionality (Amorim-Maia et al. 2022; Liboiron 2021; Trisos et al. 2021). Mastering the “epistemological agility” (Haider et al. 2018) this requires, however, places additional demands on researchers and researcher schools, and—for us—further blurs the boundaries between the science and the self.

These mismatches and disillusionment are paving the way for a release phase (Fig. 1) where academia can be radically reimagined to better align practices with values. We found several precedents for this type of renewal and radical overhaul of academia going back to the dawn of universities. Two Western Anthropocene examples: the industrial revolution initiated a period of reorganization in the late 1800s which saw the rise of the specialized, disciplinary professor; the rise of the research university; and the first acceptance of women into higher education (Forest and Altbach 2007). Second, the academic reorganization post-WWII, where higher education went from elite to mass education and the number of universities rose by 75% (Forest and Altbach 2007). We note these examples are approximately 70 years apart, and perhaps it is thus not surprising that this new status quo is feeling rigid and needs renewal after another 70 years.

## Reimagining academia: sustainability for people and planet

How do we navigate this time of creative destruction to create an academic research environment that is sustainable for both people and the planet? Here we propose some tangible first steps.

We need to start by having uncomfortable discussions around international mobility. The romanticism around fieldwork and conferences in far-away places, funded by grant money is, of course, dream-like for many individuals. But it is a privilege that both rubs against ethics and equity and is unsustainable in light of climate change: we need to fairly distribute the limited global carbon budget and consider partnerships that broaden our ways of knowing in favor of parachuting in as foreign experts. The idea that it is better for academics, primarily from the Global North, to repeatedly travel, and in some cases build their entire career, on research topics and contexts that are geographically (and often culturally) far removed from their university home conflicts with notions of anti-colonialism and who is best suited for knowledge creation. We see this tension in our author group, where some of us undertake long-distance travel for fieldwork, some have already changed our topics and field of research in light of this, and others are trying to adapt our projects due to competing tensions and feelings of hypocrisy.

Similarly, flying to conferences is being questioned, in particular by young scholars and sustainability scientists. However, the entrenched system of mobility does not make this resistance easy. Perhaps the funding allocation does not allow for the often more expensive travel by train and the associated accommodation. Due to the romanticism of this hypermobile way of academic life, many conferences are also placed in ‘exciting’ locations rather than ones that are easily accessible with ground travel (Jäckle 2022; Stroud and Feeley 2015). On the conference front, there are many initiatives to try and rethink the status quo (Kreil 2020), visualizing the system dynamics and indicating that some organizations are partly already at the reorganization phase. One of these initiatives that are being tested at the moment is a satellite or multi-hub conference, which has already proved to be successful (Angst 2022). These local or regional satellites to a global conference combine the idea of in-person networking and being able to attend seminars with global speakers, while only traveling shorter distances which are often possible by train (Parncutt et al. 2021).

We propose that these types of modular approaches could be more widely adopted in academia. Not only for conferences, but also research project design. Instead of individual researchers flying around the world for fieldwork, perhaps projects can be built up in a modular way, with research hubs in different geographical contexts that are connected through increased access and usability of online meeting tools. Local researchers who are both already in-country and have the local cultural, language and knowledge expertise could perform the context-dependent side of the research. Expertise can then be shared across institutions and countries without the need for individuals to fly and then learn from scratch for

every project. If capacity building is needed that requires long-distance flights, the flights could be reversed so that the local project leaders fly to a central location for training—also providing more globally equitable sharing of the remaining carbon budget. This type of modular research design could also allow for novel case study comparisons across geographical regions.

We also need to heed the increasing calls to rethink what knowledge is, how it is created and assessed, and its wider implications for academia (Lazurko et al. 2020). While knowledge co-production is increasingly present in many areas of sustainability science (Caniglia et al. 2021; Norström et al. 2020; Chambers et al. 2021), the current status quo in Western science at large is often that knowledge arises from the researchers; that it takes the form of theories, models, and methods; and can be adequately assessed through citation and publication metrics. This needs to be reimagined. We need to broaden the notion of who creates knowledge to include transdisciplinary formats and appreciate that knowledge co-creation is needed to take complex dynamics and translate them into effective communication or policy action. With an expansion of what knowledge is, we need tools and metrics to assess this broader notion of knowledge to make sure that regardless of the type of knowledge creation, future career prospects for researchers are not diminished.

Lastly, we need to be kind to ourselves as individuals during this turbulent process of change. Our discussions for this perspective piece started due to the discomfort and often-times guilt we feel by trying to live in line with our values, informed by the knowledge we have through our research in sustainability science, in a world built on a model where unsustainable practices are rewarded. It is incredibly difficult and often impossible to reduce your socio-environmental footprint, especially when we broaden the notion beyond emissions to include ecosystem degradation, pollution, social conditions, and equity. This struggle is, of course, bigger than academia, and is a result of the wider status quo of the societies we have built. So, while we do what we can to the best of our abilities within what the system allows at the moment, we will also push for change in academia and the wider world.

We hope that academia, pushed forward by the scholars in it, takes this window of opportunity for creative destruction to radically reimagine and reorganize itself into a new phase where it can be both sustainable for people and the planet. We, therefore, hope that we will be a transitional generation who will use our values and discomfort to help reshape practices and change the status quo. We urge everyone to have uncomfortable conversations, navigate personal tensions through kindness, and rethink what knowledge is and how it is created.

**Funding** Open access funding provided by Stockholm University. The author(s) received no financial support for the research, authorship, and/or publication of this article.

## Declarations

**Conflict of interest** The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Amorim-Maia A, Anguelovski I, Chu E, Connolly J (2022) Intersectional climate justice: a conceptual pathway for bridging adaptation planning, transformative action, and social equity. *Urban Clim* 41:101053. <https://doi.org/10.1016/j.uclim.2021.101053>
- Angst M (2022) Hosting a conference satellite for the first time—five lessons learned. <https://marioangst.com/en/blog/posts/hub-lessons/>. Accessed 14 Apr 2023
- Armstrong McKay DI, Staal A, Abrams JF, Winkelmann R, Sak-schewski B, Loriani S, Fetzer I, Cornell SE, Rockström J, Lenton TM (2022) Exceeding 1.5°C global warming could trigger multiple climate tipping points. *Science* 377(6611):eabn7950. <https://doi.org/10.1126/science.abn7950>
- Arsenault J, Talbot J, Boustani L, Gonzalès R, Manaugh K (2019) The environmental footprint of academic and student mobility in a large research-oriented university. *Environ Res Lett* 14(9):095001. <https://doi.org/10.1088/1748-9326/ab33e6>
- Berné O, Agier L, Hardy A, Lellouch E, Aumont O, Mariette J, Ben-Ari T (2022) The carbon footprint of scientific visibility. *Environ Res Lett* 17(12):124008. <https://doi.org/10.1088/1748-9326/ac9b51>
- Bilecen B, Van Mol C (2017) Introduction: international academic mobility and inequalities. *J Ethn Migr Stud* 43(8):1241–1255. <https://doi.org/10.1080/1369183X.2017.1300225>
- Bjørkdahl K, Duharte F (eds) (2022) *Academic flying and the means of communication*. Springer, Berlin. <https://doi.org/10.1007/978-981-16-4911-0>
- Caniglia G, Luederitz C, von Wirth T et al (2021) A pluralistic and integrated approach to action-oriented knowledge for sustainability. *Nat Sustain* 4:93–100. <https://doi.org/10.1038/s41893-020-00616-z>
- Care O, Bernstein MJ, Chapman M et al (2021) Creating leadership collectives for sustainability transformations. *Sustain Sci* 16:703–708. <https://doi.org/10.1007/s11625-021-00909-y>
- Ceballos G, Ehrlich PR, Barnosky AD, García A, Pringle RM, Palmer TM (2015) Accelerated modern human-induced species losses: entering the sixth mass extinction. *Sci Adv* 1(5):e1400253. <https://doi.org/10.1126/sciadv.1400253>

- Chambers JM, Wyborn C, Ryan ME, Reid RS, Riechers M, Serban A, Bennett NJ, Cvitanovic C, Fernández-Giménez ME, Galvin KA, Goldstein BE, Klenk NL, Tengö M, Brennan R, Cockburn JJ, Hill R, Munera C, Nel JL, Österblom H et al (2021) Six modes of co-production for sustainability. *Nat Sustain* 4(11):983–996. <https://doi.org/10.1038/s41893-021-00755-x>
- Clark WC (2007) Sustainability science: a room of its own. *Proc Natl Acad Sci* 104(6):1737–1738. <https://doi.org/10.1073/pnas.0611291104>
- Climate Action Tracker (2022) Warming projections global update, December 2022. <https://climateactiontracker.org/>. Accessed 14 Apr 2023
- Dance A (2023) Stop the peer-review treadmill. I want to get off. *Nature* 614(7948):581–583. <https://doi.org/10.1038/d41586-023-00403-8>
- Forest J, Altbach P (2007) International handbook of higher education, vol 18. Springer, Berlin. <https://doi.org/10.1007/978-1-4020-4012-2>
- Gewin V (2021) Pandemic burnout is rampant in academia. *Nature* 591(7850):489–491. <https://doi.org/10.1038/d41586-021-00663-2>
- Glover A, Strengers Y, Lewis T (2017) The unsustainability of academic aeromobility in Australian universities. *Sustain: Sci Pract Policy* 13(1):1–12. <https://doi.org/10.1080/15487733.2017.1388620>
- Gunderson LH, Holling CS (2002) Panarchy: understanding transformations in human and natural systems. Island Press, Washington
- Haider LJ, Hentati-Sundberg J, Giusti M, Goodness J, Hamann M, Masterson VA, Meacham M, Merrie A, Ospina D, Schill C, Sinare H (2018) The undisciplined journey: early-career perspectives in sustainability science. *Sustain Sci* 13(1):191–204. <https://doi.org/10.1007/s11625-017-0445-1>
- IPBES (n.d.) Indigenous knowledge and biodiversity. UNESCO. <https://en.unesco.org/indigenous-knowledge-and-biodiversity/ipbes>. Retrieved 29 Nov 2022
- IPCC (2022) Climate change 2022: mitigation of climate change. <https://www.ipcc.ch/report/ar6/wg3/>. Accessed 14 Apr 2023
- Jäckle S (2022) The carbon footprint of travelling to international academic conferences and options to minimise it. In: Bjørkdahl K, Franco Duharte AS (eds) Academic flying and the means of communication. Springer, Berlin, pp 19–52. [https://doi.org/10.1007/978-981-16-4911-0\\_2](https://doi.org/10.1007/978-981-16-4911-0_2)
- Jouffray J-B, Blasiak R, Norström AV, Österblom H, Nyström M (2020) The blue acceleration: the trajectory of human expansion into the ocean. *One Earth* 2(1):43–54. <https://doi.org/10.1016/j.oneear.2019.12.016>
- Kates RW (2011) What kind of a science is sustainability science? *Proc Natl Acad Sci* 108(49):19449–19450. <https://doi.org/10.1073/pnas.1116097108>
- Köhler JK, Kreil AS, Wenger A, Darmandieu A, Graves C, Haugestad CAP, Holzen V, Keller E, Lloyd S, Marczak M, Međugorac V, Rosa CD (2022) The need for sustainability, equity, and international exchange: perspectives of early career environmental psychologists on the future of conferences. *Front Psychol*. <https://doi.org/10.3389/fpsyg.2022.906108>
- Kreil A (2020) Measures for academic air travel reduction. From measures for academic air travel reduction.pdf (ethz.ch)
- Lam DP, Hinz E, Lang D, Tengö M, Wehrden H, Martín-López B (2020) Indigenous and local knowledge in sustainability transformations research: a literature review. *Ecol Soc* 25(1). <https://doi.org/10.5751/ES-11305-250103>
- Langin K (2022) As professors struggle to recruit postdocs, calls for structural change in academia intensify. <https://www.science.org/content/article/professors-struggle-recruit-postdocs-calls-structural-change-academia-intensify>. Accessed 14 Apr 2023
- Larsen P, von Ins M (2010) The rate of growth in scientific publication and the decline in coverage provided by Science Citation Index. *Scientometrics* 84(3):575–603. <https://doi.org/10.1007/s11192-010-0202-z>
- Lazurko A, Alameciak T, Hill LS, Muhl E-K, Osei AK, Pomezanski D, Schang K, Sharmin DF (2020) What will a PhD look like in the future? Perspectives on emerging trends in sustainability doctoral programs in a time of disruption. *World Futures Rev* 12(4):369–384. <https://doi.org/10.1177/1946756720976710>
- Liboiron M (2021) Decolonizing geoscience requires more than equity and inclusion. *Nat Geosci* 14(12):876–877. <https://doi.org/10.1038/s41561-021-00861-7>
- Lubchenco J (1998) Entering the century of the environment: a new social contract for science. *Science* 279(5350):491–497. <https://doi.org/10.1126/science.279.5350.491>
- Meho LI (2007) The rise and rise of citation analysis. *Phys World* 20(1):32. <https://doi.org/10.1088/2058-7058/20/1/33>
- Norström AV, Cvitanovic C, Löf MF, West S, Wyborn C, Balvanera P, Bednarek AT, Bennett EM, Biggs R, de Bremond A, Campbell BM, Canadell JG, Carpenter SR, Folke C, Fulton EA, Gaffney O, Gelcich S, Jouffray J-B, Leach M et al (2020) Principles for knowledge co-production in sustainability research. *Nat Sustain* 3(3):182–190. <https://doi.org/10.1038/s41893-019-0448-2>
- Olsson P, Folke C (2001) Local ecological knowledge and institutional dynamics for ecosystem management: a study of Lake Racken watershed, Sweden. *Ecosystems* 4(2):85–104. <https://doi.org/10.1007/s100210000061>
- Paasche Ø, Österblom H (2019) Unsustainable science. *One Earth* 1(1):39–42. <https://doi.org/10.1016/j.oneear.2019.08.011>
- Parncutt R, Lindborg P, Meyer-Kahlen N, Timmers R (2021) The multi-hub academic conference: global, inclusive, culturally diverse, creative, sustainable. *Front Res Metr Anal*. <https://doi.org/10.3389/frma.2021.699782>
- Rousi E, Kornhuber K, Beobide-Arsuaga G, Luo F, Coumou D (2022) Accelerated western European heatwave trends linked to more-persistent double jets over Eurasia. *Nat Commun* 13(1):Article 3851. <https://doi.org/10.1038/s41467-022-31432-y>
- Sellberg MM, Cockburn J, Holden PB, Lam DP (2021) Towards a caring transdisciplinary research practice: navigating science, society and self. *Ecosyst People* 17(1):292–305
- Steffen W, Broadgate W, Deutsch L, Gaffney O, Ludwig C (2015) The trajectory of the Anthropocene: the Great Acceleration. *Anthropocene Rev* 2(1):81–98. <https://doi.org/10.1177/2053019614564785>
- Stroud J, Feeley K (2015) Responsible academia: optimizing conference locations to minimize greenhouse gas emissions. *Ecography* 38:402–404. <https://doi.org/10.1111/ecog.01366>
- Trisos C, Auerbach J, Katti M (2021) Decoloniality and anti-oppressive practices for a more ethical ecology. *Nat Ecol Evol* 5(9):1205–1212. <https://doi.org/10.1038/s41559-021-01460-w>
- UNEP (2021) Over 1,000 universities and colleges make net-zero pledges as new nature initiative is unveiled. UN Environment. <http://www.unep.org/news-and-stories/press-release/over-1000-universities-and-colleges-make-net-zero-pledges-new-nature>. Accessed 14 Apr 2023
- UNFCCC (2022) Nationally determined contributions under the Paris Agreement - Synthesis Report by the secretariat. [https://unfccc.int/sites/default/files/resource/cma2022\\_04.pdf](https://unfccc.int/sites/default/files/resource/cma2022_04.pdf)
- Walker B, Salt D (2006) Resilience thinking: sustaining ecosystems and people in a changing world. Island Press, Washington

Wang-Erlandsson L, Tobian A, van der Ent RJ, Fetzer I, te Wierik S, Porkka M, Staal A, Jaramillo F, Dahlmann H, Singh C, Greve P, Gerten D, Keys PW, Gleeson T, Cornell SE, Steffen W, Bai X, Rockström J (2022) A planetary boundary for green water. *Nat Rev Earth Environ* 3(6):380–392. <https://doi.org/10.1038/s43017-022-00287-8>

World Meteorological Organization (2022) *State of the global climate 2021*. Geneva, 57 p. ISBN 978-92-63-11290-3

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.