The imperative for actions to protect and promote human health within Earth-system boundaries

The *Lancet Planetary Health*–Earth Commission Report[1] provides major new insights into the potential for the transgression of Earth-system boundaries (ESBs) to undermine the prospects for health and development for current and future populations. The Commission deepens conceptual understanding of safe and just ESBs and the imperative of tackling the profound inequities in consumption patterns driving the planetary-level changes that are described in compelling detail. The Commission also provides valuable guidance on how policies to achieve equitable human progress within ESBs can be developed and implemented, including at the city level and by private entities.

The Commission has important implications for research and policy. The spatial heterogeneity of some Earth-system processes emphasises the need for research to address geographical gaps in knowledge, particularly because a safe boundary is conceptualised to ensure the biophysical stability of the Earth system and might not protect populations from harm, including to health, from transgression of the boundary. At-risk populations, particularly those living in low-income settings, can experience harms at lower levels of environmental disruption, such as in the case of climate change for which millions of people encounter effects at less than the safe ESB of 1·5°C (see the World Weather Attribution). This disruption suggests the need articulated by the Commission for a lower boundary of 1°C, to address climate justice.[1]

Current research is often focused on a single environmental threat, such as the recent growth of research outputs on climate change and health,[2] but increasingly, research should address the effects of multiple Earth systems changes that occur simultaneously. For example, the effects of reduced rainfall on crop yield and nutrition might to be greater in regions where freshwater aquifers are depleted[3] and the combination of climate and land use change could greatly increase the risk of zoonotic disease transmission to humans.[4] An integrative approach to developing and evaluating potential solutions is also needed because some policies could have benefits for multiple ESBs, such as supporting shifts to predominantly plant based diets that could affect greenhouse gas emissions, land use, freshwater use, and nitrogen and phosphorus loading.[5]

An exclusive focus on one ESB could also lead to trade-offs for both health and the environment. One example is the promotion of biofuels for climate change mitigation that depending on the type of biofuel, could result in monocultures, thus reducing biodiversity, competing with food, and contributing to air pollution.[6] Decreased rainfall in some regions due to climate change can increase consumption of freshwater from aquifers and might result in the ingestion of hazardous levels of arsenic and fluoride.[7] Circular economy strategies that prioritise recycling, remanufacturing, and reuse of products to reduce greenhouse gas emissions could increase exposure to harmful pollutants; for example, the discharge of large quantities of microplastics from plastic recycling facilities.[8]

Investments in actions to address ESBs should be accompanied by rigorous evaluation to ensure that the intended outcomes are achieved and to minimise the potential for greenwashing and health washing (ie, whereby false or exaggerated claims are made about the benefits of actions). Current guidance, such as the National Institute for Health and Care Research–Medical Research Council guidance on the development and evaluation of complex interventions to improve health, should, where relevant, be adapted to include metrics reflecting the ESBs addressed by the intervention.

Keeping up to date with rapidly changing evidence on ESBs and health requires better strategies for updating systematic reviews, including the use of machine learning, that will increasingly make it possible to update evidence almost in real time and thus create living reviews (see Cochrane Community Living Systematic Reviews). Such efforts should also be accompanied by assessments of risk of bias and confidence in research findings.

There is growing evidence that merely describing the adverse effects of environmental change is insufficient to stimulate policy action and that a positive message emphasising the near-term benefits of action, such as improved mental and physical health, livelihoods, and

For the **World Weather Attribution** see https://www.worldweatherattribution.org/

For **Cochrane Community Living System Reviews** see https://community.cochrane.org/review-development/resources/living-systematic-reviews#what

employment prospects can support more ambitious action.[9] The *Lancet* Pathfinder Commission synthesised evidence about the major potential near-term health co-benefits from intersectoral climate mitigation actions, including from reduced air pollution, increased consumption of healthy diets, and increased physical activity from active travel and public transport.[10] Better evidence of the health and economic benefits of actions to address ESBs can help support ambitious action, but many of the barriers to change are related to political economy and governance challenges. These barriers are exacerbated by growing geopolitical rivalries and fragmented international legal regimes that have spurred economic insecurity, undermining international order and multilateral institutions.[11] Increasing misinformation and disinformation and the distrust of political leaders further complicate attempts to address the root causes of the transgressions of ESBs.

The *Lancet Planetary Health*–Earth Commission Report, in articulating calls for reform of the UN system, makes recommendations for an Earth-system governance regulatory body, and efforts to adapt the structure of the UN Security Council. However, questions remain about how such a body would come into being or how any reformed governance structure would effectively implement the goals of the report within the existing intergovernmental system. In addition, such a body should integrate oversight of human progress, including in health and with Earth system governance, capitalising on the opportunity to embed planetary health concepts in the post-2030 agenda, which will follow on from the Sustainable Development Goals.

The Rockefeller Foundation–*Lancet* Commission on Planetary Health was published a decade ago.[12] Although the report was shaped by the concept of planetary boundaries, the Commission membership comprised particularly on expertise in public health and allied disciplines. The latest report reflects deep knowledge of Earth systems with a strong emphasis on environmental justice. Future commissions on the topic would benefit from transdisciplinary membership, spanning all relevant disciplines from the outset and drawing systematically on the work of previous Commissions. The membership should include political scientists, international lawyers, and experts with extensive knowledge of the global governance arena, and indigenous voices.

Transdisciplinary capacity strengthening to address interconnected planetary challenges and their implications for health, and to evaluate potential actions to address these challenges requires substantial investment in human resources and equitable collaborations, particularly in low-income and middle-income settings and among national and sub-national policy makers and implementers.

Lastly, monitoring progress towards planetary health requires integration of both Earth systems and health data to create a planetary health monitoring system. Such a system could monitor trends in relation to ESBs and the effects of their transgression on human health. There are many barriers to such integration, including confidentiality issues, different spatial and temporal scales of available data, a lack of reliable national statistics in many countries, legal implications, and inadequate funding and capacity. However, with vision and commitment, together with advances in data availability and computing power, these obstacles can potentially be addressed. A key objective should also be to create a demand from decision makers and the wider public for such data, to support efforts to navigate political realities in a cohesive, coherent, and diplomatic manner.

Greater understanding of geopolitical uncertainties, national and international law, and diplomacy is essential, among researchers and implementers alike, to determine how calls to action can be implemented within the current geopolitical context. Recommendations on how to resolve planetary challenges should be adequately supported by a plan of action to take them forward that is based on knowledge from a wide range of disciplines and accompanied by regular progress reviews.

AH is a Principal Investigator of the Pathfinder Initiative, was until recently Co-investigator for the Sustainable Healthy Food Systems research programme and Complex Urban Systems for Sustainability and Health, all funded by the Wellcome Trust; received additional funding from the Oak Foundation for the Pathfinder Initiative; reports royalties from Cambridge University Press; received travel support from WHO and the Human Frontiers Science Program; is a member of the Cool Roofs trial steering committee (Nouna Research Centre, Burkina Faso and University of Heidelberg, Germany) and the US National Academy of Medicine Climate Grand Challenge steering committee; was until recently the Co-chair of the International Advisory Committee, National Institute for Health and Care Research Clean-Air (Africa) Global Health Research Unit and InterAcademy Partnership, Climate change and health working group; is a member of the Independent Advisory Group, Collaboration for the Establishment of an African Population Cohort Consortium; was Co-director of the WHO Collaborating Centre on Climate Change, Health and Sustainable Development until August 2024; is Chair of the Standards for Official statistics on Climate-Health Interactions expert advisory group; and is a scientific advisor

to the World Organization of Family Doctors working party on planetary health. JM declares no competing interests.

*Andy Haines, Jemilah Mahmood
andy.haines@lshtm.ac.uk

Centre for Climate Change and Planetary Health, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK (AH); Sunway Centre for Planetary Health, Sunway University, Selangor, Malaysia (JM)

1 Gupta J, Bai X, Liverman DM, et al. A just world on a safe planet: a *Lancet Planetary Health*–Earth Commission report on Earth-system boundaries, translations, and transformations. *Lancet Planet Health* 2024; **8:** e813–73.
2 Berrang-Ford L, Sietsma AJ, Callaghan M, et al. Systematic mapping of global research on climate and health: a machine learning review. *Lancet Planet Health* 2021; **5:** e514–25.
3 Bhattarai N, Pollack A, Lobell DB, et al. The impact of groundwater depletion on agricultural production in India. *Environ Res Lett* 2021; **16:** 085003.
4 Carlson CJ, Albery GF, Merow C, et al. Climate change increases cross-species viral transmission risk. *Nature* 2022; **607:** 555–62.
5 Springmann M, Clark M, Mason-D'Croz D, et al. Options for keeping the food system within environmental limits. *Nature* 2018; **562:** 519–25.
6 Muscat A, de Olde EM, de Boer IJM, Ripoll-Bosch R. The battle for biomass: a systematic review of food-feed-fuel competition. Global Food Security, 2020.
7 Li C, Gao X, Xin Zhang X, Wang Y, Ken Howard K, Groundwater fluoride and arsenic mobilization in a typical deep aquifer system within a semi-arid basin. *J Hydrol* 2022; **609:** 127767.
8 Brown E, MacDonald A, Allen S, Allen D. The potential for a plastic recycling facility to release microplastic pollution and possible filtration remediation effectiveness. *J Hazard Mater Adv* 2023; **10:** 100309.
9 Dasandi N, Graham H, Hudson D, et al. Positive, global, and health or environment framing bolsters public support for climate policies. *Commun Earth Environ* 2022; **3:** 239.
10 Whitmee S, Green R, Belesova K, et al. Pathways to a healthy net-zero future: report of the *Lancet* Pathfinder Commission. *Lancet* 2024; **403:** 67–110.
11 Ernst-Ulrich P. Governance failures: UN law and WTO law fail to protect sustainable development. In: Ernst-Ulrich P. Transforming world trade and investment law for sustainable development. Oxford Academic, 2022: 57–89.
12 Whitmee S, Haines A, Beyrer C, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–*Lancet* Commission on planetary health. *Lancet* 2015; **386:** 1973–2028.