

New research quantifies the conditions needed for communities and economies to thrive - and provides guide for leaders to operate within Earth's finite limits

31st May 2023

- Safe and Just Earth System Boundaries provide one of the most holistic measurements of Earth's finite limits, and mark a step change in understanding how to protect people and planet.
- New quantifications of the limits of Earth's vital systems (such as climate, biodiversity, water and air) include *impacts on people* - measured for the first time in the same units as planetary stability.
- The findings underscore the urgent need for action across all Earth's vital systems, the injustice inherent in current world targets, and the need for just transformations.
- The analysis is set to become the scientific backbone of the next generation of sustainability targets and practices, which are broadening their focus beyond climate, and is aligned with the recently published 'science based targets for nature' by the Science Based Targets Network.
- Leaders call on the public and private sectors to urgently adopt the boundaries in their sustainability efforts, to mitigate risk and create the conditions for thriving societies and economies.

New research published today in Nature defines a set of Earth System Boundaries that scientifically quantify safety of people as well as stability of the planet - which until now have not been measured in the same units. This work builds on existing knowledge and marks a leap in understanding of how to protect the planet's finite resources and create the conditions necessary for communities and economies to thrive.

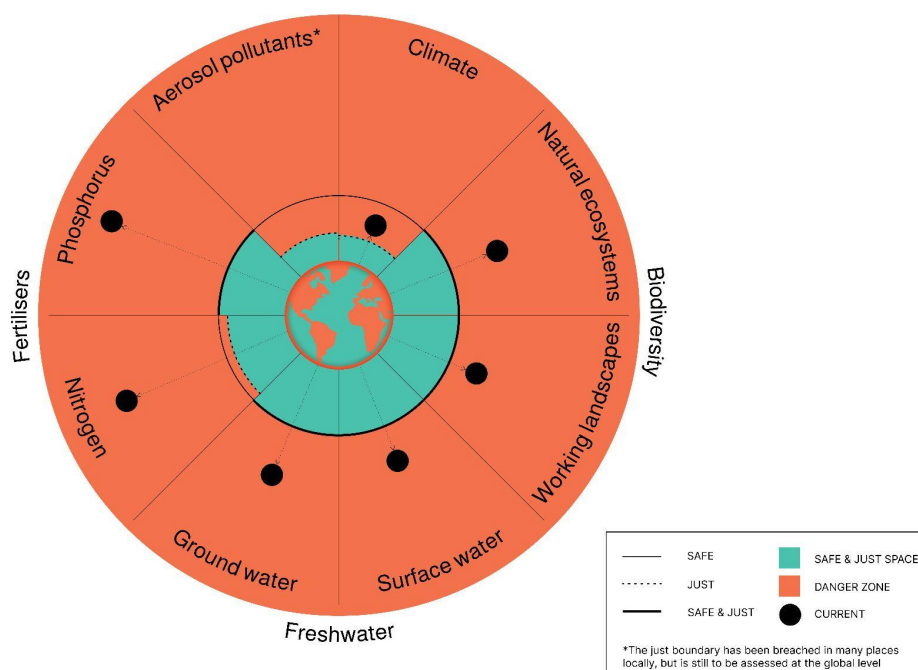
Co-authored by over forty leading natural and social scientists from the **Earth Commission**, and led by **Prof. Johan Rockström**, **Prof. Joyeeta Gupta** and **Prof. Qin Dahe**, the Safe and Just Earth System Boundaries provide a scientific foundation for assessing the stability and resilience of the planet and the connection therein with human wellbeing. These Earth System Boundaries can guide companies and governments in evaluating risks, performance and opportunities as they navigate urgent efforts to achieve a net zero, nature positive and equitable future, especially in combination with just transformation practices.

The Earth Commission was established by the **Global Commons Alliance** – a coalition of 70+ leading organisations working to safeguard the global commons, including the **World Economic Forum**, **World Business Council For Sustainable Development**, **The Nature Conservancy**, **Capitals Coalition**, and **Future Earth** - which hosts the scientific secretariat of the Earth Commission.

The Earth System is made up of many interconnected processes that keep our planet stable or - when disrupted - radically alter its ability to provide a habitable environment. The Earth Commission's research explores processes in *climate*, *air*, *water* - both ground and surface water - *biodiversity* - within natural ecosystems and working landscapes - and *fertilisers* - both nitrogen and phosphorus.

While previous research such as the 'Planetary Boundaries' have studied the 'safe' limits of these processes, this is the first to incorporate 'justice' into scientific analysis, using the same units of measurement. This means the scientists identified limits at which humans are protected from significant harm resulting from planetary changes. These 'just' boundaries are in some places more stringent than the 'safe' boundaries. Additional work from the Commission identifies the conditions needed for people to access resources for a dignified life.

Safe and Just Earth System Boundaries



Almost all of the Safe and Just Earth System Boundaries have been breached, adding urgency for accelerating action to meet existing sustainability goals, including the Paris Agreement for climate, the Kunming-Montreal Global Biodiversity Framework, and the 2030 Sustainable Development Goals. This science emphasises that these goals must also be achieved in a just manner.

Prof. Johan Rockström, Director of the Potsdam Institute for Climate Impact Research and co-author of the report, said: "All the models today that take us to net zero assume that nature will continue to provide buffering capacity against global warming. There are nine biophysical processes and systems that regulate the state of the Earth System - the Planetary Boundaries - the Earth Commission took six of these and scientifically quantified them with safety and

justice considerations to indicate a safe landing zone for people and the planet. Working holistically across these domains is crucial to our ability to reach net zero.”

Prof. Joyeeta Gupta, Professor of Environment and Development in the Global South at the University of Amsterdam and co-author of the report, said: “Justice is a necessity for humanity to live within planetary limits. This is a conclusion seen across the scientific community in multiple heavyweight environmental assessments, including our own. It is not a political issue. Overwhelming evidence shows that a just and equitable approach to both goal setting and transformation to achieve the goals is essential to planetary stability. We cannot have a safe planet without justice. Anyone building a resilient company, institution or nation for the long term must work towards this future.”

Prof. Dahe Qin, Co-Chair of the Earth Commission and Director of the Academic Committee, Chinese Academy of Sciences and co-author of the report, said: “The Earth System is in danger, as many tipping elements are about to cross their tipping points. So far, seventeen tipping elements are identified in scientific literature, among them, nine are cryosphere-related. The Asia High Mountain Cryosphere (AHMC) for example is fast changing and close to becoming a new tipping element, which can impact the regional social-economy.”

Prof. Xuemei Bai, Distinguished Professor, Australian National University, and co-author, said: “This study brings into focus the human dimension of the climate debate. In putting a number on human needs and impacts, it shows how the protection of the planet is inseparable from the success of communities, societies and economies. These Boundaries enable businesses to understand their fair share of resources and responsibilities, and to take measurable action to minimise their footprint on the planet that also helps improve human wellbeing.”

A call for leadership

As the most up-to-date understanding of the planet’s limits to supporting thriving societies, the Safe and Just Earth System Boundaries are set to become the scientific underpinning for the next generation of sustainability targets, expectations and actions. For example, the **Science Based Targets Network** - a group of organisations providing tools for companies to transform their impact on nature - has just released its first iteration of targets for water and land, which are informed by the scientific literature, and are now being road tested by seventeen major companies. By designing sustainability efforts around the Safe and Just Earth System Boundaries and just transformation, business leaders will be able to stay ahead of scrutiny, remain competitive, and thrive in the long term.

“This science is critically important for business. It connects climate to nature, freshwater, clean air and other global commons and defines what is needed to secure our collective future. It highlights how the current trajectory is untenable for the global economy and society.

Businesses will face interacting crises and escalating risks in their operations and supply chains, which will destroy value. This new research will become the scientific underpinning for how businesses can and should build strategy, set targets and implement action to mitigate the risks and exercise leadership to safeguard the conditions for their continued success.” said **Gim Huay, Managing Director, Centre for Nature and Climate at the World Economic Forum**

Setting a course for the ‘Safe and Just space’

This emerging science quantifies both the influence of humans on the Earth System, and the influence of the Earth System on humans. Building on existing frameworks, it integrates a justice perspective for the first time - which includes minimising human exposure to significant harm, and ensuring access to the resources needed for a dignified life and freedom from poverty for everyone.¹ By quantifying these conditions in the same units of measurement as the conditions for stability, the scientists say they have defined the Safe and Just Boundaries.

Of the eight Earth Systems, human activities have pushed seven beyond their Safe and Just Boundaries and into the risk zone - threatening both planetary and human health. This highlights the urgent need for global leadership, rapid decision-making and just transformation toward a ‘Safe and Just space.’

Transforming our economies to operate within the limits of the planet offers huge opportunities for business leaders to stay ahead of regulatory scrutiny, meet the expectations of an increasingly conscious consumer and stakeholder base, and protect the communities, economies and natural resources upon which their operations depend. These boundaries allow leaders to see a more complete picture of the risks they face and supercharge their sustainability efforts, with a comprehensive framework for measurement and action that can be applied across markets, at both national and regional level. Global businesses including **AB InBev, Carrefour, GlaxoSmithKline PLC, H&M Group, Holcim Group, Nestle** and **Tesco** are now setting science-based targets for nature alongside their climate targets, informed by the same science that Earth System Boundaries have drawn from.

This work is more prescient than ever following the recent IPCC AR6 Synthesis Report, which stressed that - despite the richest 1% of the world’s population being responsible for double the CO2 emissions of the poorest 50% - climate change has increased inequality, and will continue to do so without action. This science will equip leaders to build justice and human wellbeing into their decision-making on sustainability.

¹ Significant harm is defined as: widespread severe existential or irreversible negative impacts on countries, communities and individuals from Earth System change, such as loss of lives, livelihoods or incomes, displacement, loss of food, water or nutritional security, chronic disease, injury or malnutrition.

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Appendix 1. Breakdown and short explanation of each boundary

[Aerosols](#)

[Climate](#)

[Freshwater](#)

[Fertilisers](#)

[Biodiversity](#)

Additional Supportive Quotes

Additional quotes will be available from Milltown Partners at publication date

Razan al Mubarak, UN Climate Change High-Level Champion from the COP28

Presidency; President of the International Union for Conservation of Nature:

"We are in a race to net zero and a race to resilience for our climate. We also need to be in a race to nature if we want to secure a safe and just future for all people. These Earth System boundaries provide an important scientific underpinning for that race, and provide multiple different entry points for businesses to strengthen their climate action. Urgent, integrated action is key and the time to start is now".

Marc Benioff, Salesforce Chair and CEO:

"As global citizens and businesses, it's our collective responsibility to respond to this planetary emergency. That's why I'm so excited about the important work of the Earth Commission to measure the impacts of nature on the wellbeing of all people and the resilience of economies. This research unlocks a critical new way of thinking about the

business case for protecting the planet and taking actions that will safeguard it for the generations to come.”

Christiana Figueres, former Executive Secretary, UNFCCC, co-founder of Global Optimism, and co-host of Outrage + Optimism:

“In 1992 humans created the Biodiversity and Climate conventions for multilateral action, and for too long we’ve assumed that these issues were separate from each other. That separation has guided government and corporate acting and thinking on the environment for the past thirty years. What this new science makes clear is that the Earth system is not made from separate building blocks: everything is interdependent, including human beings. The urgency to act is not new - we know we are breaking boundaries - but the insight from this groundbreaking science: that if we act holistically and put human wellbeing and equity at the centre we can have a safe and just space on Earth for all future generations, gives us even more reason to be stubbornly optimistic such a future is possible. I hope this science creates a real mindset shift for government and corporate action”.

Paul Polman, business leader and co-author of ‘Net Positive: how courageous companies thrive by giving more than they take’, former CEO of Unilever:

“This robust and comprehensive science will allow governments and industry to understand and improve – for the first time – their impact on our Earth against human boundaries as well as biophysical, planetary boundaries. In practice, for CEOs, taking this people-centric approach is going to mean more ambitious and urgent targets and actions. Following the research, as we should, will mean setting the bar higher, but ultimately setting it where it belongs, with human-beings at the heart of our collective efforts to build a better and safer future for all.”

Jane Madgwick, Executive Director of the Global Commons Alliance:

"It's shocking to see how far into the danger zone we are for so many areas that we rely on for our safety and stability. At the same time, it's reassuring to see - in clear, quantified terms - the contours of a safe and just space that would allow people and planet to thrive. I am committed to making sure, that through the Global Commons

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Alliance, these Earth System Boundaries will inform and spark the urgent action necessary, across all sectors and scales."

Erin Billman, Executive Director of the Science Based Targets Network:

"The science is clear: we need urgent action right now across climate and nature because our Earth system is fundamentally interconnected. At the Science Based Targets Network we're helping companies with the critical "how" and the "what can we do about it" questions. We now have clear guidance that companies can use today to set integrated climate and nature targets - with an initial focus on freshwater and land - based on science, so that they can play their part in ensuring an equitable, net zero, nature positive future".