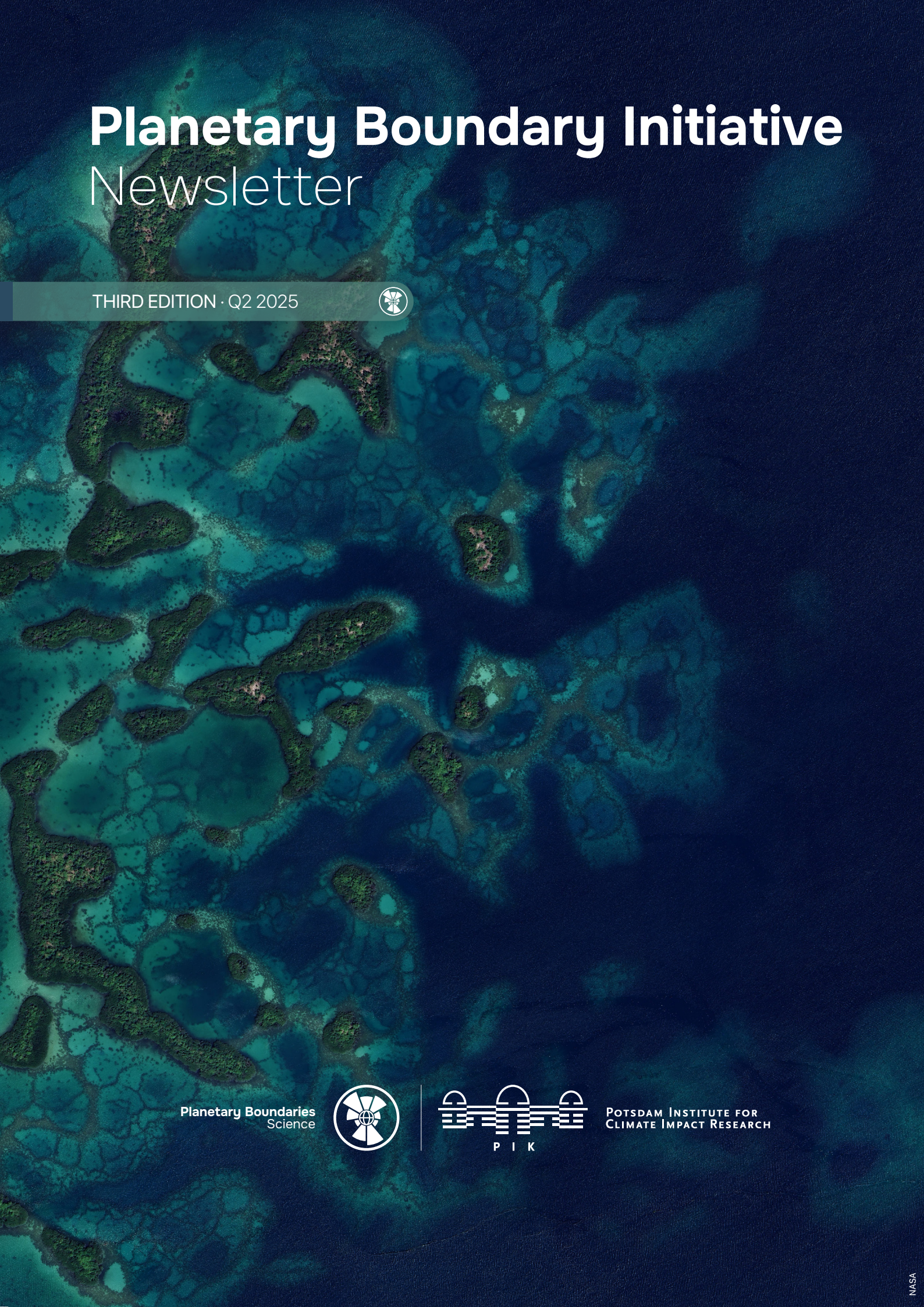
Planetary Boundary Initiative
Newsletter

THIRD EDITION · Q2 2025



Planetary Boundaries Science

PIK

Potsdam Institute for Climate Impact Research

NASA

While Planetary Boundary science has advanced tremendously over the past decades, we still lack a deep understanding of the intricate, yet pivotal connections between many biological and physical functions of the Earth system.

In late 2023, the **Potsdam Institute for Climate Impact Research** and its partners launched a major scientific effort to improve both our ability to model how the Earth system evolves under the pressure of human activity, as well as our ability to measure the state of the Earth system at a high temporal resolution: **Planetary Boundaries Science (PBScience)**.

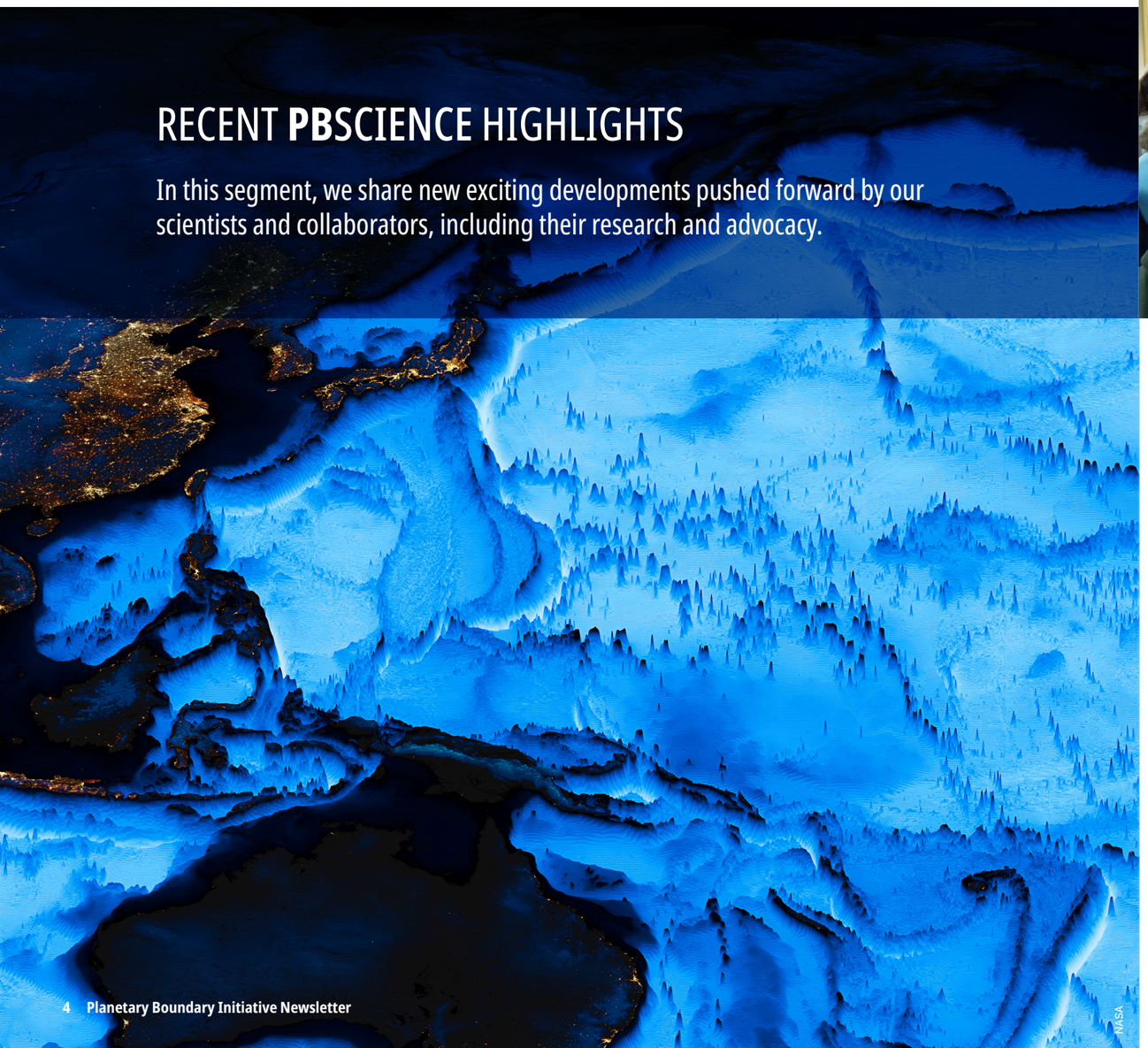
NASA

WELCOME TO THIS THIRD NEWSLETTER OF THE **PLANETARY BOUNDARY INITIATIVE (PBI).**

Here, you find updates on **Planetary Boundaries Science** and related research efforts conducted at the **Potsdam Institute for Climate Impact Research (PIK)** and beyond. Read on for news on our steadily growing science initiative, cutting-edge **Planetary Boundaries (PB)** research results, and exclusive insights into the PBScience effort.

RECENT **PB**SCIENCE HIGHLIGHTS

In this segment, we share new exciting developments pushed forward by our scientists and collaborators, including their research and advocacy.



NASA







PB OCEAN WORKSHOP WITH **SYLVIA EARLE** & GLOBAL EXPERTS

Text: Levke Caesar | Photos: Bruce Phillips

From 5–7 May 2025, the Planetary Boundaries Science team hosted an international expert workshop to update the Planetary Boundaries (PB) framework with the latest scientific findings. Participants included oceanographer and National Geographic Explorer **Sylvia Earle**, PB framework co-developer **Katherine Richardson** (University of Copenhagen), and biogeochemist **Ron Milo** (Weizmann Institute of Science), alongside researchers from institutions such as the Leibniz Centre for Tropical Marine Research, Senckenberg Natural History Collections, and the University of California Santa Clara. The workshop brought together more than 20 scientists from multiple countries to evaluate how changes in the ocean systems, such as shifts in circulation, oxygen loss, and ecosystem disruption, can be better captured through using multiple global dataset measurements.

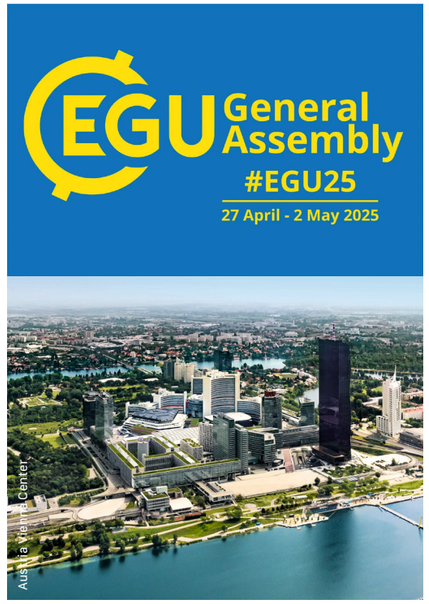
By building bridges across disciplines and institutions, the workshop marked an important step toward more comprehensively integrating the ocean into global sustainability science. The momentum is already growing: a research group has reached out to co-organize a follow-up workshop next year, further expanding this collaborative effort to strengthen the ocean dimension in global sustainability science. An upcoming review paper will summarize key insights and serve as a foundation for further research and collaboration.

HIGHLIGHTING THE PLANETARY BOUNDARIES AT EUROPE'S BIGGEST **GEOSCIENCE CONFERENCE**

Text: Kasra R. Shahi

PIK's **PBScience Lab** and **Earth Resilience Science Unit (ERSU)** co-chaired a session at the **European Geosciences Union (EGU) General Assembly 2025** in Vienna, Austria, which hosted over 20,000 participants from around the world. Our session: "**Earth resilience in the Anthropocene: tipping points, planetary boundaries and human–Earth system interactions**" addressed the growing risks to Earth's stability driven by increasing human pressures and explored how complex biological, physical and socio-economic factors interact to influence global resilience.

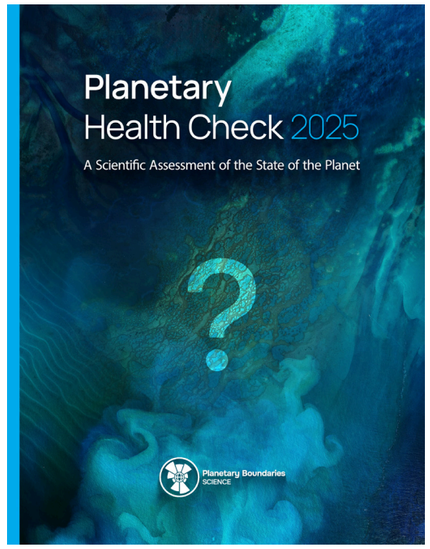
Presentations addressed these challenges from a variety of perspectives. For instance, one study presented a case study on biosphere (living systems) health to help us decide on a key planetary boundary threshold. Another contribution showcased an analysis of Earth system interactions, demonstrating how local-scale changes can collectively shape global Earth system trajectories. The session provided a platform for the PBScience team to present their ongoing research and engage with the wider scientific community.



"TEASER" FOR THE 2025 PLANETARY HEALTH CHECK REPORT

Text: Niklas Kitzmann

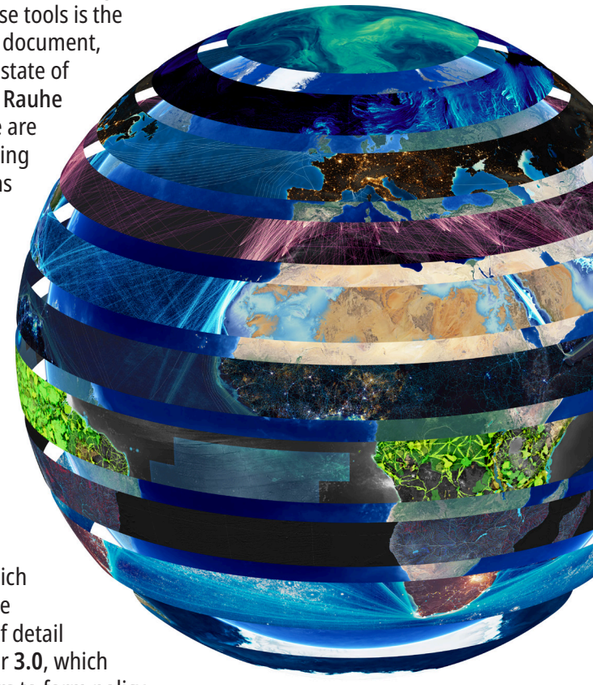
You will be pleased to know that the **Planetary Health Check 2025** report is well underway and this edition brings several key updates. There is an extra special focus on the **ocean**, with an in-depth deep dive (pun intended) as well as ocean themes running through several chapters. In addition to this, as our group of contributors has grown significantly by including a diverse range of international experts, the report draws on an even broader base of expert knowledge. You can also look forward to a newly improved and updated design and graphics. Lastly, we will be premiering articles written by several well known guest authors, adding fresh voices and perspectives to give depth and context to our most up to date Planetary Boundaries assessment. **The Launch of the Planetary Health Check 2025 is on the 24th September 2025.**



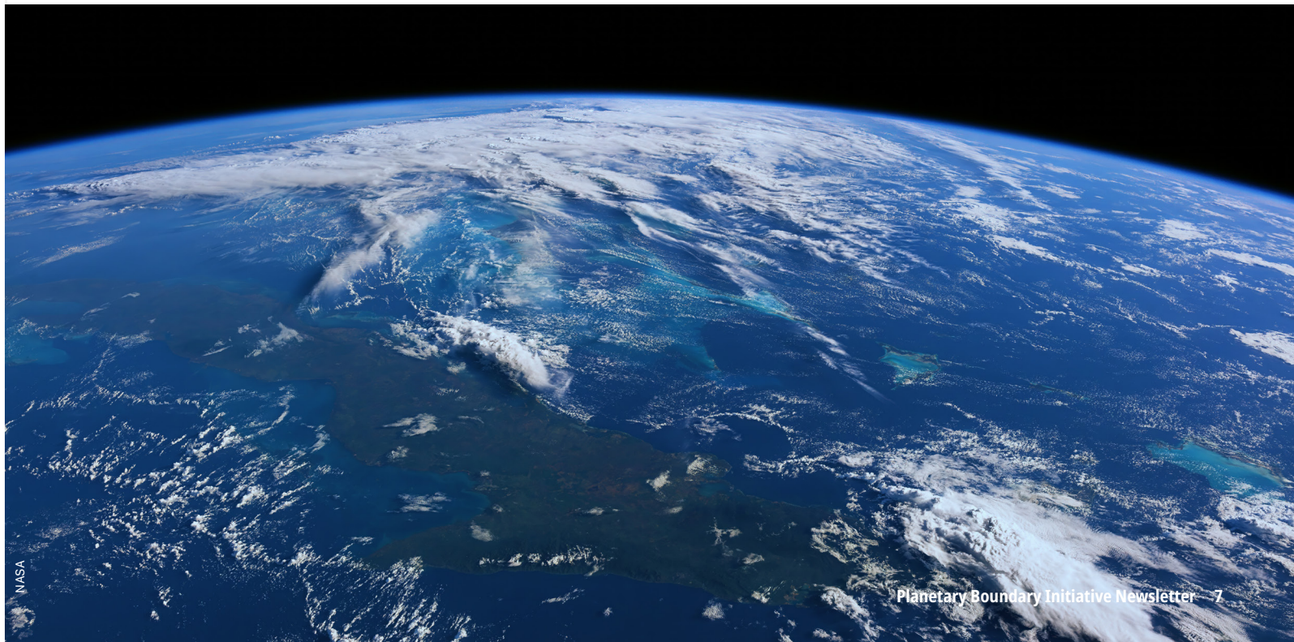
PBANALYZER — BRINGING GLOBAL DATASETS TOGETHER

Text: Hannes Rauhe/Bruce Phillip

At the **Planetary Boundaries Science Lab**, building tools to make Earth system science more transparent and robust is of high importance. One of these tools is the **Planetary Boundaries Analyzer**, a new platform designed to document, reproduce, and trace the data and methods used to assess the state of Earth's planetary boundaries. Currently, our specialist, **Hannes Rauhe** is building the first of three planned versions of this tool. There are a lot of factors to consider on such a project but Hannes is making excellent progress and making sure the data driven foundations are really solid to build upon with an expanding range of partners and collaborations. The excitement is growing about the potential of the analyzer. So what are the 3 versions in development?



The Planetary Boundary (PB) Analyzer **1.0** is the essential first step in revolutionizing how we assess Earth's environmental thresholds. Developed as the foundation of a broader vision, this open-source tool translates traditional planetary boundary assessments into an efficient and reproducible digital workflow. It retrieves data, runs calculations, and generates visuals, all at the push of a button, making rigorous environmental monitoring both accessible and efficient. With PB Analyzer 1.0, the groundwork is laid for PB Analyzer **2.0**, which uses big data processing tools, AI, and machine learning to give state of the art analysis of the planetary boundaries in a level of detail never seen before. This in turn allows us to move to PB Analyzer **3.0**, which takes us from global to local level. This will help decision makers to form policy, businesses to align with sustainability targets and local communities to assess risk and find the right pathway.







UN **OCEAN CONFERENCE**

Text and Visuals: Aeon Alvarado Amaro

Co-organized by France and Costa Rica, the third **United Nations Ocean Conference (UNOC3)** took place from June 9 to 13 in Nice, France. More than 14,000 participants including 2,000 scientists and over 60 world leaders came together to create action plans, share expertise, learn from others and strengthen the connection between researchers, institutions, organizations and the civil society.

There were panel discussions, workshops, and even documentary screenings like "**Ocean with David Attenborough**" and "**Deep Rising**" and on June 12th, at the European Digital Ocean Pavilion, there was a panel discussion titled "**The Ocean and Planetary Boundaries: Unlocking a Deeper Vision for the Earth's Future**" which aimed to explore how to better represent the ocean in the Planetary Boundaries framework. The event started with a video keynote by **Johan Rockström**, followed by the input of several scientists who presented their ideas on how to extend the framework.

At the end of the panel discussion, **Sabine Mathesius**, an Ocean specialist at PIK who is deeply involved in strengthening the representation of the Ocean within the Planetary Boundaries framework, provided insights into the current work and progress of the PBScience Lab towards this goal.



Captain **Paul Watson**, Planetary Guardian Dr. **Sylvia Earle**, **Solomon Pili Kahoʻohalahala** (Uncle Sol), **Shari Sant** during the "*Deep Sea Mining: What's At Stake And How We Can Stop It*" event at Oceans House, Nice.
Planetary Guardians Archive.

PLANETARY GUARDIANS AT THE UN OCEAN CONFERENCE UNOC3: **MOBILIZING FOR OCEAN ACTION**

Text and Visuals: Karin Watson, Planetary Guardians

The **Planetary Guardians** were also at the **Third UN Ocean Conference (UNOC3)**, where over 14,000 delegates and 100,000 civil society participants convened in Nice, France, under the theme "*Accelerating action to conserve and sustainably use the Ocean*." Outcomes included progress on ratifying the **High Seas Treaty (BBNJ)**, major national commitments like French Polynesia's plan to fully protect its waters, new initiatives such as the **One Ocean Finance Facility**, and €23 billion pledged for ocean protection.

Planetary Guardians played a key role throughout, spotlighting the links between ocean health, climate stability, biodiversity, and Indigenous leadership. Dr. **Sylvia Earle** was a leading voice against deep-sea mining and for stronger protections of ecosystems like the Southern Ocean. Guardians **Xiye Bastida**, **Hindou Ibrahim**, and **Christiana Figueres** joined conversations on ocean-climate solutions, finance, food systems, and the power of culture in driving change. The conference closed with the adoption of "*Our Ocean, Our Future: United for Urgent Action*," reaffirming global commitment to SDG 14.

Read ocean calls to action from Guardians Sylvia Earle, Jane Goodall, and Richard Branson in **The Observer's Ocean Series**.



“FIELDS OF THE FUTURE” WITH THE **BERLIN FUTURIUM**

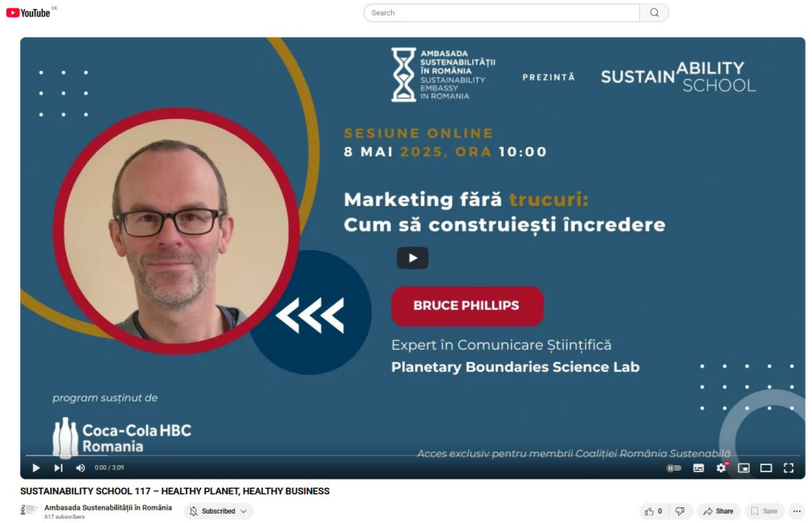
Text and Visual: Levke Caesar

When the **Futurium**, Berlin’s museum of (many possible!) futures, invited me to speak at their special evening “*Fields of the Future*” in late May, I knew this wouldn’t be a typical science talk. The forecourt had been transformed into a living, vertical landscape (see image). And rather than giving a standard presentation, I was asked to contribute a lecture performance—an unusual but exciting format meant to highlight the many perspectives, interests, and tensions surrounding the reform of agriculture.

I shared the stage with a remarkable and diverse group of voices: a literary scholar and former chair of the German Science Council, a regenerative farmer and an NGO working towards ending world hunger, who brought in the global dimension of food justice and new perspectives. Together, we asked the fundamental question: *What kind of agriculture can nourish both people and the planet?*

I was there not only as a climate scientist but as someone trying to connect the dots between challenges that are too often addressed in isolation: climate change, food security, and the biodiversity crisis. In my contribution, I emphasized that land use is not a local issue; it’s a planetary one. Agriculture is the second-largest driver of climate change, a key contributor to biodiversity loss, and increasingly vulnerable to the very disruptions it helps create. If we want to ensure food security in a warming world, we must fundamentally rethink how we grow, trade, and value food. This doesn’t mean rejecting technology, but it does mean embracing deep structural reform. We need to restore soil health instead of depleting it, protect ecosystems while feeding a growing population, and align agricultural policy with the limits of our planet.

What made the evening so powerful was the deliberate diversity of perspectives: scientists, artists, farmers, philosophers, and engaged citizens all contributed to a shared exploration of the future of agriculture. No single discipline holds the solution to these interwoven challenges. Only together, we can begin to chart a path forward.



INTRODUCING THE PLANETARY BOUNDARIES TO THE **ROMANIAN SUSTAINABILITY EMBASSY**

Text: Bruce Phillips | Image: Sustainability School Romania

As part of our expanding outreach program, our Planetary Boundaries Science communicator, Bruce Phillips, presented at an online webinar to the Sustainability Embassy of Romania on the topic of “Healthy Planet, Healthy Business”. The Sustainability Embassy of Romania is a successful NGO with a clear mission: to promote and accelerate sustainable development across Romania.

In a well attended seminar with people from wide range of professions, from the renewable energy industry to tourism, Bruce presented on how the planetary boundaries framework can be applied, and provided new insights into local impacts of exceeding the planetary boundary thresholds. The post seminar questions and answers clearly indicated that many businesses have a keen interest in the planetary boundaries and specifically the solutions that can develop based on them. Some of the highlights of the seminar are found here: https://www.youtube.com/watch?v=LRdxUdORknc.

This presentation has led to new collaborations and extended outreach on the planetary boundaries in Romania.



PUBLISHING THE PHC REPORT SUMMARY IN **VARIOUS LANGUAGES**

Text & Visuals: Clara Nicolai

The state of the planet is a topic that concerns all humans living on Earth. While we publish the annual **Planetary Health Check (PHC)** report in English, we are aware that language, even in today's AI-supported day and age, can be a major hurdle to communicate to diverse audiences. This is why we initiated the translation of the PHC report's executive summary into various languages. This first round of translations was entirely based on volunteer contributions, mostly by researchers at PIK. Thanks to PIK's international research cadre, we were able to assemble teams for most of the UN languages as well as for several additional ones. For quality control, each translation team had to consist of at least three volunteers. This first-ever translation effort was more than simply the translation of a text, but rather a philological, philosophical and etymological exercise to find (or create!) terms to bring the Planetary Boundaries Framework to life in a different language. Consequently, an additional output from this process was a **glossary** of the most important terms from within the "PB Universe" and their definitions.

Currently, translations of the 2024 executive summaries and respective glossaries are available in **French**, **Spanish**, **Russian**, and **German** under the following link (**Mandarin Chinese** is currently undergoing an additional review and should be available under the same link soon): https://www.pik-potsdam.de/en/institute/labs/pbscience/translations-1

For the upcoming 2025 report, we are planning to release several translations of the executive summary directly at or shortly after the launch. If you would like to volunteer as a translator or have contacts to translators with a science background that may be interested to support this effort on a pro bono basis, please contact pbscience@pik-potsdam.de. Volunteers will be mentioned by name in the respective translations.



LONDON CLIMATE ACTION WEEK (LCAW): COLLABORATING FOR CLIMATE SOLUTIONS

Text and Visuals: Karin Watson, Planetary Guardians

LCAW: Collaborating for Climate Solutions

London Climate Action Week 2025 convened global leaders to accelerate climate solutions ahead of COP30, focusing on climate ambition, financing the transition, net-zero delivery, and mobilizing diverse sectors.

Planetary Guardians were active throughout, amplifying the urgency of a just, nature-positive, and climate-resilient future. **Mary Robinson** played a key role as facilitator of the **Global Ethical Stocktake**, guiding a collective vision rooted in ethics, justice, and planetary boundaries. **Paul Polman** championed the business case for sustainability, highlighting how finance, data, and corporate leadership can drive nature-positive transformation.

Guardians **Xiye Bastida** and **Hindou Oumarou Ibrahim** also joined key dialogues on Indigenous leadership, youth action, and the role of culture in climate solutions. Across diplomatic and grassroots spaces, they called for collaboration grounded in justice, innovation, and a whole-Earth approach to deliver a 1.5°C future.

Global Ethical Stocktake, hosted at Kew Gardens in London, including Planetary Guardians Mary Robinson and Paul Polman, and COP30 Presidency team members Marina Silva, Ana Toni, and Andrea Correa do Lago
Credit: Isabela Castilho

OUTLOOK

UPCOMING EVENTS, ACTIVITIES AND PUBLICATIONS RELATED TO THE PLANETARY BOUNDARY INITIATIVE AND RELATED RESEARCH TEAMS

21-25 JULY
FRAMEWORKS, FACTS, VALUES:
IMPROVING DISCUSSIONS ON SENSITIVE CLIMATE TOPICS

PBScience Lab co-lead Dr. **Levke Caesar** will participate in this meeting just outside London that aims to promote better and more respectful communication across communities and ideological divides, by better understanding the facts (beliefs), values, and decision making processes that lead people to adopt different positions. Participants come from a wide range of backgrounds, including Earth system sciences, economics, development, social and economic policy, and platforms for climate action.

3-8 AUGUST
IEEE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM (IGARSS)

Dr. **Kasra Rafiezadeh Shahi**, our AI and EO expert, will be presenting an ongoing project titled *"Harnessing Satellite-Based Earth Observation for Monitoring Planetary Boundaries: Opportunities and Challenges"* at the International Geoscience and Remote Sensing Symposium (IGARSS) 2025. His talk will highlight the current strengths and limitations of EO satellite fleets, offering insights into both the opportunities and challenges of leveraging EO technologies to monitor planetary boundaries. In addition to his presentation, he will also be co-chairing a session on *"The Role of AI in Unveiling Climate Change Patterns"*. This session will feature cutting-edge applications of AI, particularly deep learning, in Earth system monitoring. This includes innovative methods for predicting internal ice layer thickness, modeling global terrestrial water storage responses to climate factors, mapping disaster intensities from news articles using large language models, improving erosion prediction, and parameterizing ocean vertical mixing from surface data.



21-28 SEPTEMBER
NEW YORK **CLIMATE WEEK**

The Planetary Health Check 2025 will be launched on 24th September during New York Climate Week at "The New School", one of New York's most prestigious private research universities.

Featuring the **Planetary Guardians**, a Planetary Health Check update by **Johan Rockström**, Director of the **Potsdam Institute for Climate Impact Research**, and a special musical moment.

Details of the event will appear here in the coming weeks: https://events.newschool.edu
www.planetaryguardians.org

The **Planetary Health Check 2025** will update here:
www.planetaryhealthcheck.org



THANK YOU...

for your interest in Planetary Boundaries science. By providing us with feedback on our activities, you can help us to continuously improve our outreach efforts: pbscience@pik-potsdam.de

