Climate Change Law and Sustainable Development:

History, Instruments and Goals of International Climate Action

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The concept of planetary boundaries

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Research

Planetary Boundaries: Exploring the Safe Operating Space for Humanity

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ABSTRACT. Anthropogenic pressures on the Earth System have reached a scale where abrupt global environmental change can no longer be excluded. We propose a new approach to global sustainability in which we define planetary boundaries within which we expect that humanity can operate safely. Transgressing one or more planetary boundaries may be deleterious or even catastrophic due to the risk of crossing thresholds that will trigger non-linear, abrupt environmental change within continental- to planetary-scale systems. We have identified nine planetary boundaries and, drawing upon current scientific understanding, we propose quantifications for seven of them. These seven are climate change (CO_2 concentration in the atmosphere <350 ppm and/or a maximum change of +1 W m^{-2} in radiative forcing); ocean acidification (mean surface seawater saturation state with respect to aragonite ≥ 80% of pre-industrial levels); stratospheric ozone (<5% reduction in O_3 concentration from pre-industrial level of 290 Dobson Units); biogeochemical nitrogen (N) cycle (limit industrial and agricultural fixation of N_2 to 35 Tg N yr^{-1}) and phosphorus (P) cycle (annual P inflow to oceans not to exceed 10 times the natural background weathering of P); global freshwater use (<4000 km^3 yr^{-1} of consumptive use of runoff resources); land system change (<15% of the ice-free land surface under cropland); and the rate at which biological diversity is lost (annual rate of <10 extinctions per million species). The two additional planetary boundaries for which we have not yet been able to determine a boundary level are chemical pollution and atmospheric aerosol loading. We estimate that humanity has already transgressed three planetary boundaries: for climate change, rate of biodiversity loss, and changes to the global nitrogen cycle. Planetary boundaries are interdependent, because transgressing one may both shift the position of other boundaries or cause them to be transgressed. The social impacts of transgressing boundaries will be a function of the social–ecological resilience of the affected societies. Our proposed boundaries are rough, first estimates only, surrounded by large uncertainties and knowledge gaps. Filling these gaps will require major advancements in Earth System and resilience science. The proposed concept of "planetary boundaries" lays the groundwork for shifting our approach to governance and management, away from the essentially sectoral analyses of limits to growth aimed at minimizing negative externalities, toward the estimation of the safe space for human development. Planetary boundaries define, as it were, the boundaries of the "planetary playing field" for humanity if we want to be sure of avoiding major human-induced environmental change on a global scale.

Key Words: *atmospheric aerosol loading; biogeochemical nitrogen cycle; biological diversity; chemical pollution; climate change; Earth; global freshwater use; land system change; ocean acidification; phosphorus cycle; planetary boundaries; stratospheric ozone; sustainability*

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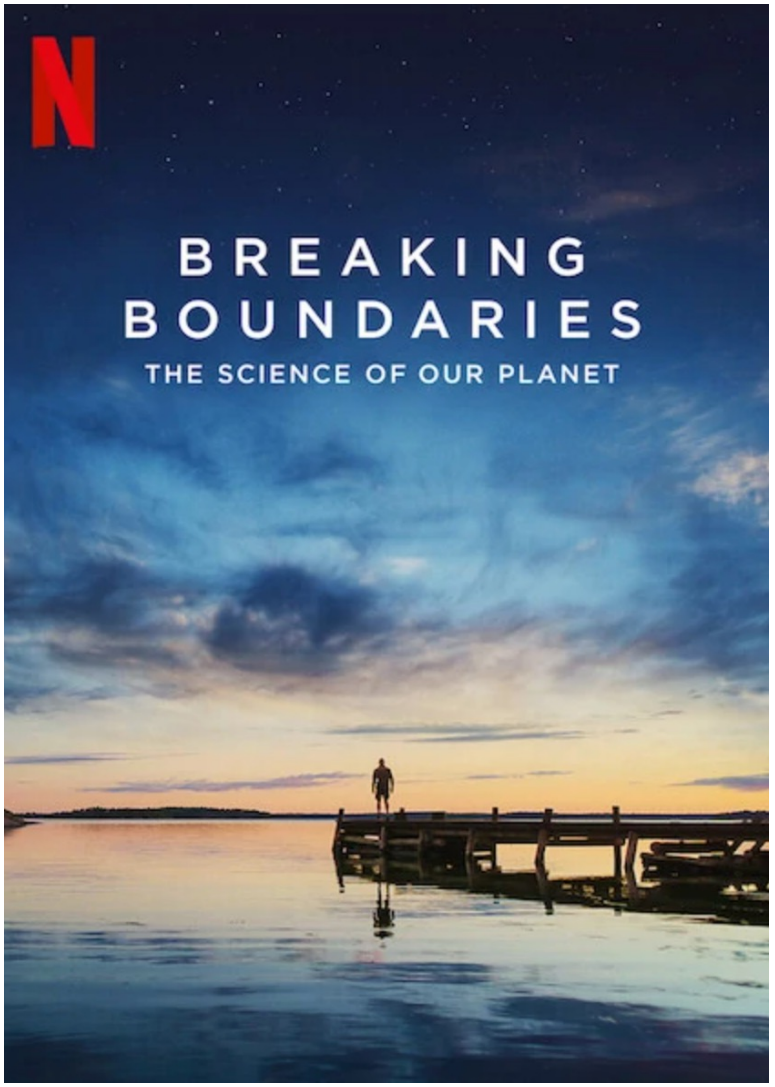


The concept of planetary boundaries

Rockström et al. (2009)

Goal: Defining "the safe operating space for humanity", i.e. a space in which human activities can take place without the risk of transgressing the Earth system's ecological thresholds

- **Planetary boundaries** = boundaries within which humanity can operate safely
- It's not about protecting the planet (as such), but protecting a **specific state of the planet** that has been favourable for human societies, namely the Holocene

The concept of planetary boundaries

Rockström et al. (2009)

- Anthropogenic pressures on the Earth System have reached a scale where **abrupt global environmental change** can no longer be excluded
- Transgressing one or more planetary boundaries may be deleterious or even catastrophic due to the **risk of crossing thresholds** that will trigger **non-linear, abrupt environmental change** within continental- to planetary-scale systems
- Main questions:

  (1) Which are the biophysical systems and processes that regulate the state and of the Earth System?

  (2) What are the quantitative boundaries for each of these systems/processes that define a safe operating space of a stable Earth System?

I. The concept of planetary boundaries

Rockström et al. (2009, 2015, 2022)

(1) Climate Change
(2) Ocean Acidification
(3) Stratospheric ozone depletion
(4) Atmospheric aerosol loading
(5) Novel entities (radioactive substances)
(6) Biogeochemical flows (nitrogen cycle)
(7) Freshwater use
(8) Land-system change (deforestation)
(9) Biosphere integrity (biodiversity)

Three key processes:

- **Climate Change**
- Ocean acidification
- Stratospheric ozone depletion

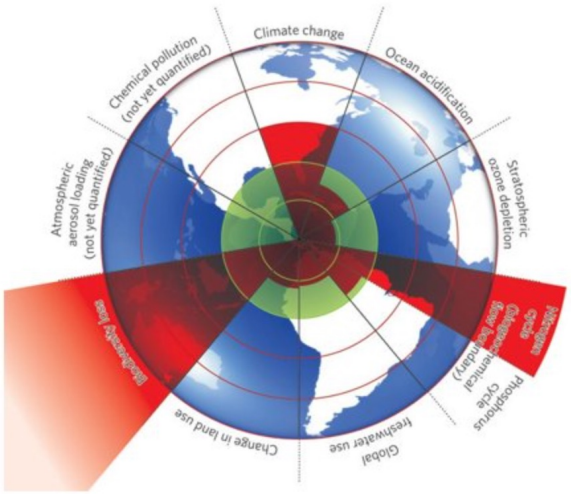
A transgression of these risks abrupt, nonlinear and potentially irreversible environmental changes, driving the planet towards a different state with unknown consequences

The concept of planetary boundaries

Rockström et al. (2009, 2015, 2022)

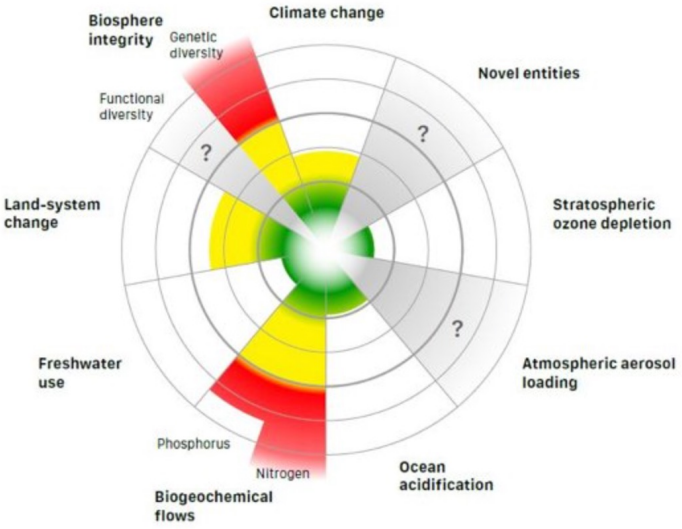
- Defining a **quantified planetary boundary** for each of the nine biophysical processes (at least one "**control variable**" for each process, and a "**ceiling value**" representing the boundary level for each control variable
- **Precautionary principle** with regard to ceiling values: each value was chosen to place the planetary boundary at the lowest level of the scientific uncertainty zone
- Example: **Climate Change**
  - Control variables: concentration of carbon dioxide in the atmosphere
  - Ceiling value: 350 parts per million (ppm)

2009



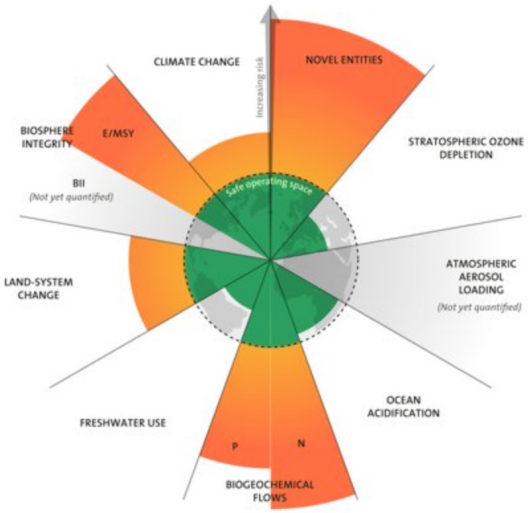
3 boundaries crossed

2015



4 boundaries crossed

2022



5 boundaries crossed

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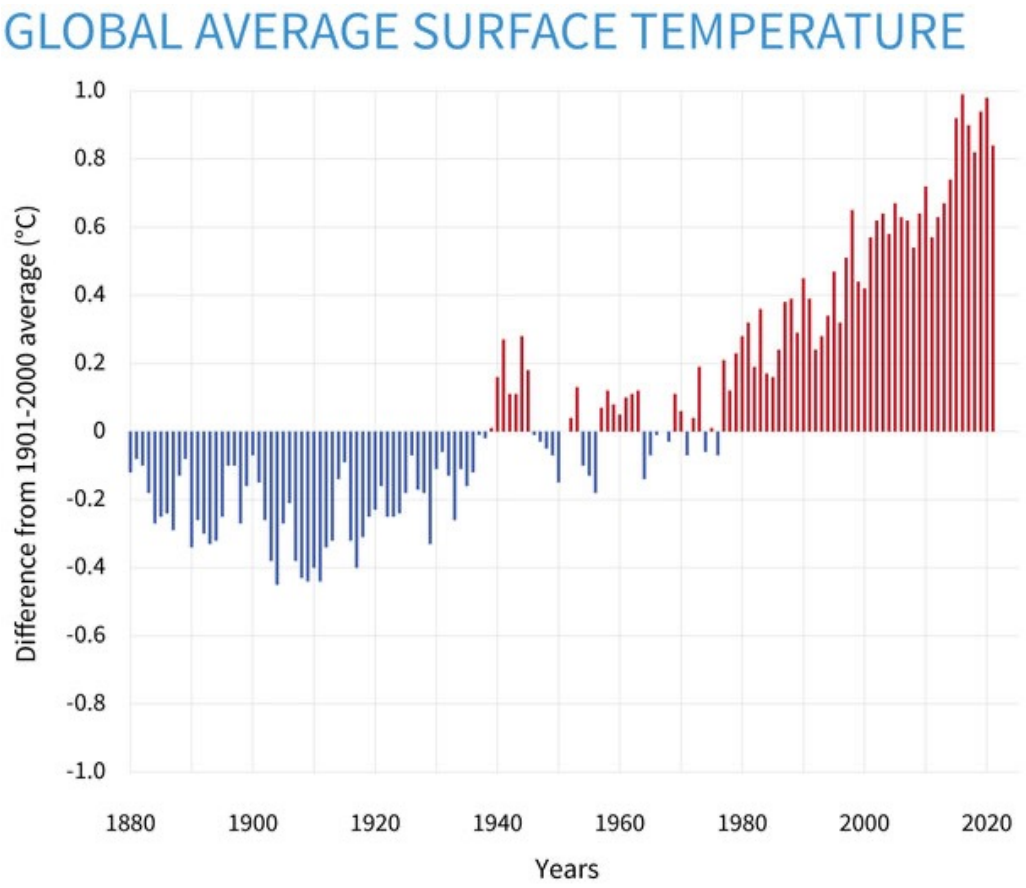
What Is Climate Change?

Climate Change = change in the global average temperature and cycles of weather over a long period of time

Global average temperature: convenient for detecting and tracking changes in **Earth's energy budget** – how much sunlight Earth absorbs minus how much it radiates to space as heat—over time



International Environmental Law – **Climate Change Law**

IPCCC report 2021

- Climate change is – undoubtedly – the result of humans
- Climate change is dangerously close to spinning out of control
- Weather extremes that have been very rare in the past become more common, and some regions are more vulnerable than others
- IPCC also called for urgent action to curb methane
- Global average temperature in the early 2030s likely to be 1.5 °C above pre-industrial levels
- Global residual CO_2 budget to likely avoid a temperature increase of 1.7 °C: 700 GtC (gigaton of carbon); (1.5 °C: 400 GtC) 2019: emission of 43 Gt CO2

Consequences of climate change

Examples

- Temperature extremes
- Reduction of snow cover and sea ice
- Heavy rainfall
- Changing habitat ranges for plants and animals (expanding some, shrinking others)

International Environmental Law – **Sources of Law**

General remarks

- International law as **cooperation law**
- **Relativity of international law**: legal obligations affect, in general, only the contracting states (exemption: ius cogens)
- **Sources of international law** (vgl. Art. 38 para 1 Statute of the ICJ)
  - Treaty law
  - Customary law
  - General principles of law
- No binding law: „soft law“ (f.ex. Rio declaration)

International Environmental Law – **Sources of Law**

International treaties

- Main source of international (environmental) law
- Self-obligation through treaty obligations as advantage and disadvantage:
  - Advantage: legal certainty; reliability
  - Disadvantage: legally obligatory only for contracting parties, even though climate change is a global task
- General difficulties of international law: implementation, enforcement; therefore: focus on compliance mechanisms

International Environmental Law – **Climate Change Law**

General remarks

- (International and national) Climate change law as a **new legal discipline** / area of law
- Climate change law covers legal approaches to both climate **mitigation** and climate **adaptation**
- Two ways of mitigation:
  - **Reduction of greenhouse gas emissions** in the atmosphere
  - Removal of greenhouse gases and their storage in sinks („**carbon dioxide removal**"); negative CO_2 emissions;

    Examples: reforestation; ocean fertilization; bioenergy with carbon capture and storage

International Environmental Law – **Climate Change Law**

Difficulties and obstacles for international climate change law

- Factual complexity
- Global effects of climate change
- Cross-divisional effects of climate change
- National path dependencies

Climate Change Law and Sustainability – **Historical development**

Landmarks of international climate change law

- 1988: UN General Assembly decision to negotiate an agreement on climate change mitigation („climate change is a common concern of mankind“)
- 1992: **United Nations Framework Convention on Climate Change** (UNFCCC)
- 1997: **Kyoto Protocol**; 3rd Conference of the Parties (COP3)
- 2015: **Paris Climate Agreement** (COP21)

Climate Change Law and Sustainability – **Historical development**

UN Framework Convention on Climate Change (1992, UNFCCC)

- UNFCCC was adopted at the Rio Conference 1992; entered into force 1994
- 1992: 157 contracting parties; today: 197 contracting parties
- Objective: to prevent dangerous anthropogenic interference with the climate system and to stabilize greenhouse concentrations (cf. Art. 2 UNFCCC)
- "Framework Convention" because it provides the formal framework for subsequent agreements, and the objectives agreed in the Convention are to be concretized in subsequent treaties
- Obligation for so-called developed countries ("industrialized countries") to reduce greenhouse gas emissions; but: no specific/quantified obligation

Climate Change Law and Sustainability – **Historical development**

Kyoto Protocol (1997, KP)

Climate protection targets and obligations

- Key innovation introduced by the KP: agreement on quantified reduction obligations within a defined period of time
- **Industrialized countries** (Annex I countries): obligation to reduce GHG emissions by at least 5 % of GHG emissions compared to 1990 within the time period 2008–2012 and by at least 18 % within the time period 2013–2020
- Ambivalent evaluation:
  - global GHG emissions increased by 38 % during the Kyoto period;
  - developed countries emissions dropped by 20 % compared to 1990 levels); but: developed countries were able to purchase emission credits from developing countries and buy their way around their commitments
  - Symbolic meaning

Climate Change Law and Sustainability – **Historical development**

Paris Climate Agreement (2015)

General remarks

- Adopted in December 2015 at COP21 in Paris; entered into force in November 2016
- 194 Parties out of 198 Parties to the Convention are Parties to the Paris Agreement
- Paris Agreement = treaty under international law, whereby the legally binding nature of each provision must be assessed individually
- For the first time, a binding agreement brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects

Climate Change Law and Sustainability – **Paris Agreement**

Targets of the Paris Climate Agreement

- **Temperature reduction targets**: hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels (Art. 2 para. 1 lit. a PA)
- Increasing the capacity to **adapt** to the adverse effects of climate change
- Changing the **flow of financial resources** towards low-emission development that is resilient to climate change

Climate Change Law and Sustainability – **Paris Agreement**

Further targets of the Paris Climate Agreement

- Reach **global peaking of greenhouse gas emissions** as soon as possible to achieve a climate neutral world by mid-century
  - Developing countries are granted a longer time frame
- Aim to achieve a **balance between anthropogenic emissions** of greenhouse gases by sources **and removals** of such gases by sinks based on equity from 2050 onwards
  - Implies net-zero emissions from 2050 onward, according to many
  - Practical implication: end of fossil fuels

Climate Change Law and Sustainability – **Paris Agreement**

Paris and the principle of common but differentiated responsibilities (CBDR)

- Parties are, inter alia, guided by the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances
  - Example: the Party's nationally determined contribution should reflect its highest possible ambition in the, reflecting the principle of CBDR
- **UNFCCC & Kyoto Protocol**: Implementation of the CBDR principle through differentiation into different groups of states ("developed states", "developing states"), which sometimes posed an obstacle (for argumentative purposes); reduction obligation only for developed states
- **Paris Agreement**: all states are obliged to reduce GHG emissions, but especially "in light of different national circumstances"; more flexible handling if necessary

Climate Change Law and Sustainability – **Paris Agreement**

Nationally Determined Contributions (NDCs)

- = key instrument for implementing the objectives of the agreement
- **Parties nationally determine their contributions to address climate change**
  - In contrast, the Kyoto Protocol prescribed emissions limitation targets top-down
  - Detailed rules on accounting and transparency to promote accountability and ambition
- „**Pledge and review**“ approach:
  - Pledge: parties nationally determine their contributions
  - Review: pledges made by the parties are evaluated individually and collectively (“global stocktake”), regarding the temperature reduction targets

Climate Change Law and Sustainability – **Paris Agreement**

Voluntary cooperation and emissions trading

- **Market mechanisms** to achieve temperature reduction targets remain to be developed
- **Three instruments are mentioned in the PA:**
  (1) Mechanism to internationally transfer mitigation outcomes (ITMO) and to use these transferred outcomes to achieve their NDCs
    - Parties need, when engaging in ITMO, promote sustainable development, ensure environmental integrity and transparency, and apply rules to ensure no double counting
    - Example: carbon market
  (2) Mechanism to contribute to the mitigation of GHG emissions and support sustainable development
  (3) Non-market-based approaches (example: capacity building; technology transfer)

Climate Change Law and Sustainability – **Paris Agreement**

Loss and damage

- "loss and damage" = refers to the destructive impacts of climate change that cannot be avoided either by mitigation or adaptation
- Loss and damage from adverse climate impacts continues to be a hotly debated issue in the climate negotiations
  - Why? Recognition of "loss and damage" could be a step towards compensation and liability
  - Accordingly, decision 1/CP.21 on the adoption of the PA stated: "Article 8 of the Agreement does not involve or provide a basis for any liability or compensation"
- **Art. 8 Abs. 1 PA**: Parties recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage
  - Inclusion of "loss and damage" as a success for Global South Countries
- "loss and damage" as a topic at COP27 in Egypt (2022)

Climate Change Law and Sustainability – **Paris Agreement**

Climate Finance and Financial Assistance

- Climate finance as one of the central topics at COP's
- In general, the Paris Agreement calls for financial assistance by Parties with more financial resources to those that are less endowed and/or more vulnerable
- Efforts under the Paris Agreement are guided by its aim of making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development
- Financial mechanism: Green Climate Fund; Global Environment Facility; Least Developed Countries Fund, Adaptation Fund
  - COP15 (Copenhagen): Parties committed to a goal of mobilizing jointly USD 100 billion per year from 2020 to 2025 to address the needs of developing countries
  - **COP26 in Glasgow** (2021): (1) Annual payments of 100 billion will probably not be reached until 2023; (2) Adaptation funding to be doubled by 2025 compared to 2019; (3) 5% fee on traded carbon credits to go into the Adaptation Fund

Climate Change Law – COP27 in Egypt (2022)

Mitigation at COP27

- **Last year – COP26 in Glasgow (2021)**: "utmost concern", "code red for humanity"; (not binding) call for revisions to targets: emissions must decrease globally by 45% between 2010 and 2030; current fear: increase of 13%
- **IPCC – September 2022**: "pledges" (combined NDC's) will lead to an expected emissions increase of 10.6 % by 2030; likely to lead to a 2.5 °C warming by the end of the century
- **COP27**:
  - no increased ambition expected; only Party that has increased its ambition (NDC) since COP26 is Australia
  - Draft of the "mitigation work programme" will be discussed, which issues to urgently scale up mitigation ambition; outcome is uncertain
  - "reality check" for deals/statements agreed at COP26, on issues from fossil fuel phase out, reducing methane emissions and ending deforestation

Climate Change Law – COP27 in Egypt (2022)

Adaptation at COP27

- **COP26** (2021): urging developed countries to at least double adaptation finance; launch a "work programme on the global goal on adaptation" (GGA): increase resilience to climate change through sustainable development
- **COP27** in Egypt takes place in a highly climate-vulnerable country on a highly climate-vulnerable continent; COP27 might increase ambition, sensibility and momentum on adaptation

Finance at COP27

- Estimation: developing countries need $2.5 trillion of external financing annually until 2030 to meet the PA and Sustainable Development Goals
- **COP26**: failure to receive (binding) promises of regular climate finance
- **COP27**: developing countries hope to see the fulfilment of historic promises, such as the $100 billion annual climate finance which developed countries were meant to deliver each year, from 2020 to 2025, but which so far has not been met
  - Problem: rich countries face financial challenges

Climate Change Law – COP27 in Egypt (2022)

"Loss and Damage" at COP27

- **COP26** (2021): breakthrough on loss and damage, including establishment of the three-year "Glasgow Dialogue" on loss and damage;
- **COP27**: "loss and damage" is on the provisional agenda

End