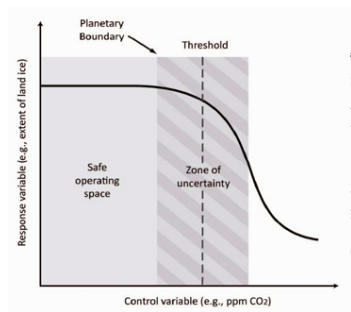
**The nine planetary boundaries framework:**

**Scientific Inquiries:**

**The first step by identifying biophysical boundaries at the planetary scale within which humanity has the flexibility to choose a myriad of pathways for human well-being and development (Rocktrom et al. 2009)**

**What are the non-negotiable planetary preconditions that humanity needs to respect in order to avoid the risk of deleterious or even catastrophic environmental change at continental to global scales?(Rocktrom et al. 2009)**

|  | **BOUNDARY** | **WHERE WE ARE TODAY** |
| --- | --- | --- |
| **1. Climate change** | **Atmospheric CO2 should be 350 ppm.** | **Currently 400 ppm** |
| **2. Lost biodiversity as species become extinct.** | **Maintain 90% of biodiversity.** | **Biodiversity has dropped to 84% in parts of the world such as Africa** |
| **3. The addition of phosphorus, nitrogen (and other elements) to the world's crops and ecosystems** | **Worldwide use per year of about 11 teragrams (Tg) of phosphorus and 62 Tg of nitrogen** | **Up to about 22 Tg per year of phosphorus and 100 To of nitrogen** |
| **4. Deforestation and other land use changes** | **Maintain 75% of the planet's original forests** | **Down to 62%** |
| **5. Emission of aerosols (microscopic particles) into the atmosphere that affects climate and living organisms** | **Global boundary unknown, but regional effects (such as on the South Asian Monsoon) occur when Aerosol Optical Depth (AOD) is more than 0.25** | **Up to 0.30 AOD over South Asia, but probably well inside (or below) the boundary over most of the globe** |
| **6. Stratospheric ozone depletion** | **Less than 5% below the pre-industrial level of about 290 Dobson Units (DU)** | **Still safely inside the boundary except over Antarctica during spring, when levels drop to 200 DU** |
| **7. Ocean acidification:** | **When the oceans become acidic enough, the minerals sea creatures need to make shells, such as aragonite, begin to dissolve.** | **Still within the boundary, which won't be crossed If we can stay within the climate boundary of 350ppm of CO2 in the atmosphere** |
| **8. Freshwater use** | **Can use up to 4000km of freshwater a year.** | **We use around 2600 km of freshwater per year** |
| **9. Dumping of organic pollutants, radioactive materials, nanomaterials, micro-plastics, and other novel or artificial substances into the world's environment** | **Unknown** | **Unknown** |

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