

FOUNDATION EARTH

Rethinking society from the ground up!

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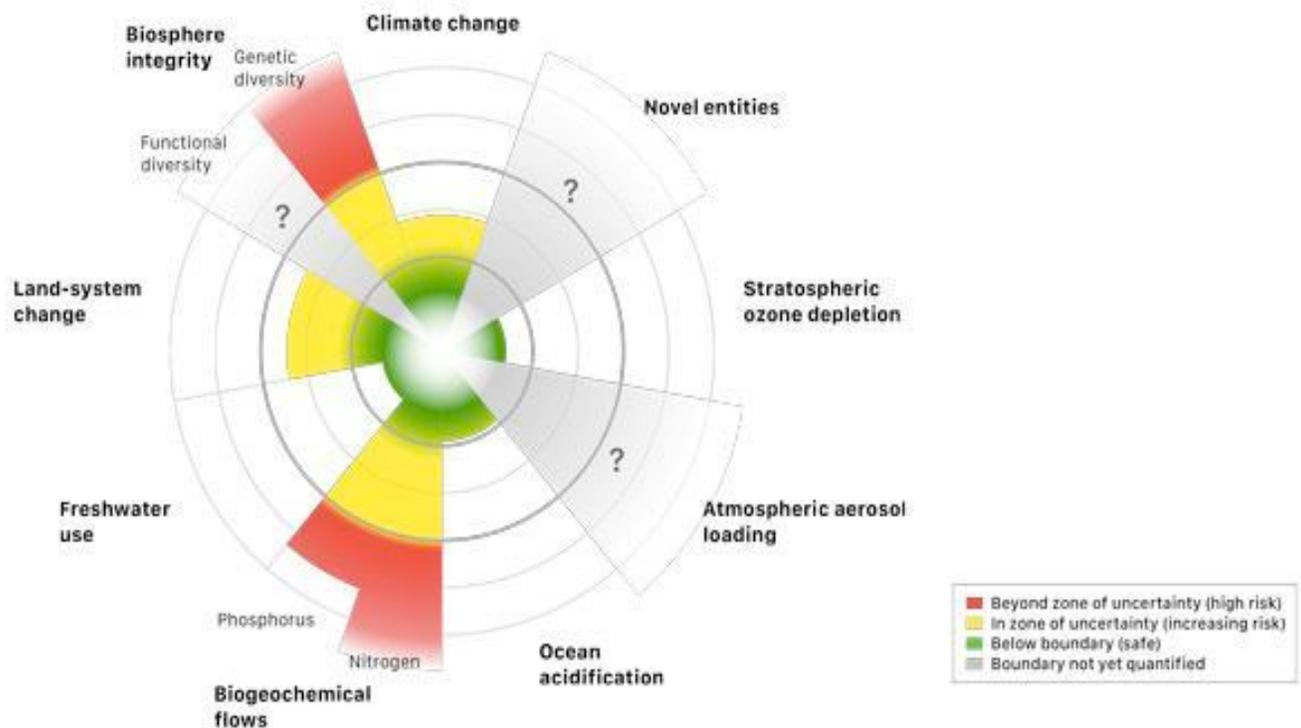
Investments & the Nine Planetary Boundaries

Basic Conditions for Life

The planet supports all life via the earth's natural systems. These systems are self-organizing and self-repairing within limits. When these limits are exceeded, the natural biophysical system starts to disintegrate making existence harder for the entire web of life and certainly us humans. In 2009, a group of 28 internationally renowned scientists identified a set of [planetary boundaries](#) within which humanity can continue to develop and thrive for generations to come alongside these natural systems. Scientists are clear on one reality: crossing certain boundaries will generate abrupt or irreversible biophysical changes and reduce the planet's ability to support life. We have no definitive idea how many important dimensions there are to the global life-support system. While imperfect, this framework is important and helpful.

These nine boundaries are as follows: freshwater use, land-system change, biosphere integrity (diversity), chemical dispersion, climate change, ocean acidification, biochemical flows (nitrogen and phosphorus cycles), stratospheric ozone depletion, novel entities (modified organisms), and atmospheric aerosol loading (air pollution).

All the boundaries are closely linked. Scientists have techniques to quantify the health of most of the boundaries, while others require more research. It is an important indicator and feedback system to ensure a healthy planet and hence a healthy human context.



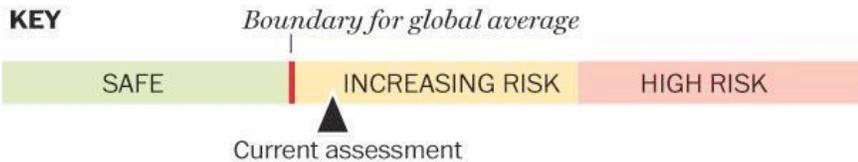
Smart Bankers & Investors

Smart bankers and investors need to have their investments respect these boundaries and help maintain global ecological stability and livability. This is a key to all economic stability. To achieve this, bankers and investors need loan seekers to disclose ecological impacts or potential impacts to the planetary systems. Bankers and investors also need internal analysis of the data and adjustments to the economic activities they want to fund. The nine planetary boundaries are:

- 1. Stratospheric Ozone Depletion:** The stratospheric ozone layer in the atmosphere filters out ultraviolet (UV) radiation from the sun. If this barrier thins, ultraviolet radiation will reach the ground and damage terrestrial and aquatic ecosystems, causing increased occurrences of skin cancer in humans. The reduction of the Antarctic ozone hole was proof that thinning can and will occur if we do not remain on the path set by the Montreal Protocol Treaty.
- 2. Biosphere Integrity:** The rate of biodiversity loss (terrestrial and marine) has escalated in the past 50 years, driven primarily by land use change for industrial agricultural use. This has resulted in ecosystem damage and species extinction. When a species goes extinct, its function in the web of life is lost. If, for example, the extinct species is a key crop pollinator, you can imagine the damage done to farmers and the ability to feed people. Research is underway to gather data and understand variables that will help shape a boundary.
- 3. Chemical Dispersion and the release of novel entities:** Emissions of toxic and long-lived substances such as synthetic organic pollutants, heavy metal compounds and radioactive materials represent some of the key human-driven changes to the planet. These compounds can have potentially irreversible effects on living organisms and on the physical environment (by affecting atmospheric processes and climate). Even when the uptake and bioaccumulation of chemical pollution is at sub-lethal levels for organisms, the effects of reduced fertility and the potential of permanent genetic damage can have severe effects on ecosystems far removed from the source of the pollution. Persistent organic compounds have caused dramatic reductions in bird populations and impaired reproduction and development in marine mammals. Further research is needed.
- 4. Climate Change:** This planetary boundary has likely already been transgressed, as evidenced by the loss of summer polar ice. Continued pressure through deforestation techniques (especially tropical rainforests) will push Earth's systems past the tipping point. A precautionary approach would be to not continue on this path to avoid potentially cataclysmic consequences.
- 5. Ocean Acidification:** Oceans absorb a quarter of human CO₂ emissions, transforming them into carbonic acid and altering ocean chemistry and water pH. This process is devastating to coral and plankton populations, which are critical to a balanced, functioning ocean. Upsetting the bottom of the food chain can pull the rug out from under the entire food pyramid. While all the boundaries are closely linked, ocean acidification is directly associated with and a result of climate change.
- 6. Freshwater Use:** Human consumption is directly responsible for the loss of freshwater supplies. It is estimated that by 2050, approximately half a billion people will suffer from lack of access to freshwater. A boundary has been proposed to help manage local, regional, and continental needs.
- 7. Land-system Change:** The global population continues to grow by the billions. Agricultural development to feed this population has caused the destruction of forests, wetlands, prairies, and other vegetation systems. This alters water flows and the natural cycling of carbon, nitrogen, and phosphorus in soil. In developing a boundary, the function, quality, and spatial distribution of a tract of land must be considered.
- 8. Biochemical Flows (Nitrogen and Phosphorus Cycling):** Human industry and agricultural practices have altered natural cycles of these two elements, both of which are essential to plant growth. Human activity converts exorbitant amounts of atmospheric nitrogen into reactive nitrogen, which pollutes waterways and coastal zones. Over application of phosphorus fertilizers can have huge regional impacts; such as killing off shrimp populations in the Gulf of Mexico or creating dead zones in the oceans.
- 9. Atmospheric Aerosol Loading:** This boundary is proposed to combat the effects of aerosols on Earth's climate system. Aerosols interact with water vapor and affect cloud formation and global and regional atmospheric circulation. Each year, an estimated 800,000 people die from consistently breathing aerosol-polluted air. However, interactions between aerosols and the atmosphere are complex, and this has hindered the clear characterization of this boundary.

In summary, we depend daily on biophysical processes for the food on our plate and the air we breathe. We are embedded in and connected to life support systems like biodiversity and eight others. Increasingly, bankers and investors get this connection. An injury to another species is an injury to humanity. The market must stop investing in industries destructive to the planetary boundaries if we are to support continued existence!

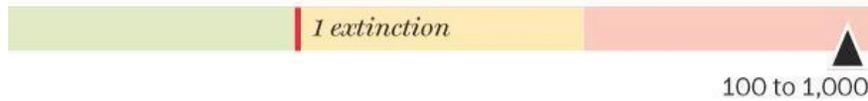
– Randy Hayes



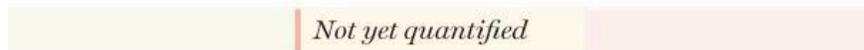
THE BOUNDARIES

Biosphere integrity

- Extinction rate – Extinctions for every 1 million species



- Biodiversity abundance – A measure of ecosystem degradation



Biogeochemical flows

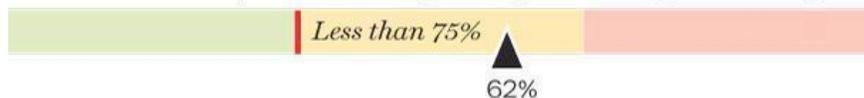
- Nitrogen – In megatons per year



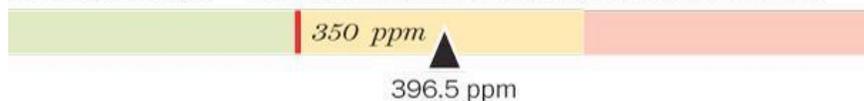
- Phosphorus – In megatons per year; flow from freshwater into ocean



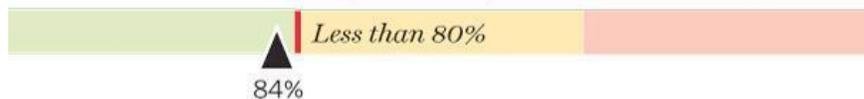
Forest cover – In percent coverage of original cover; global average



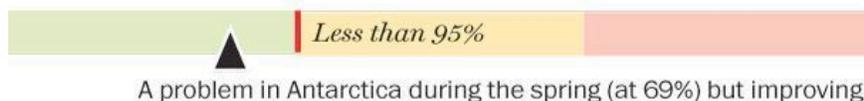
Climate change – Atmospheric carbon dioxide, in parts per million



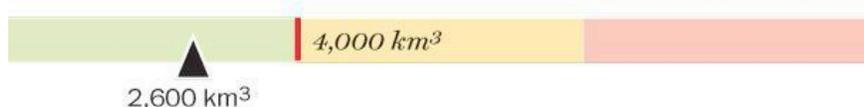
Ocean acidification – Carbonate ion concentration in seawater compared with pre-industrial levels



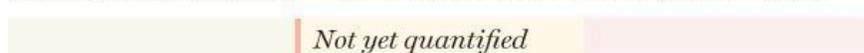
Stratospheric ozone – Concentration compared with pre-industrial levels



Freshwater use – In cubic kilometers used every year



Atmospheric aerosols – Can have serious human health impacts



Novel entities – New substances, modified life forms

