

What are planetary boundaries, and what do they mean for business?

Planetary boundaries

Hello, and welcome to our *Be Human Rights Confident* video series.

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In this video, we will delve into planetary boundaries, what they mean, where we are, and what they mean for companies.

So let's get started.

For the last 12,000 years, humanity has been living in a stable state. We had predictable seasons, reliable weather, stable oceans. This stable state of the planet is what enabled us to grow as we did. We call it the **Holocene**. It's in fact the only state of the planet that we know for certain can support us and the modern world, as we know it.

You know already from reading the news that we are no longer in a stable state. We have entered a new geological epoch, a new chapter on this planet – that we have created, called the Anthropocene. This is the chapter of history where we as people are the primary drivers of change on planet Earth.

So, how much change is too much? When will we reach a point of change that is irreversible? A tipping point that will accelerate change, that there is no coming back from?

Scientists Johan Rockström and Will Steffen have helped us answer these questions, through their development of Planetary Boundaries. So what are the systems they have identified we need to protect for our own stability? And where are we when it comes to triggering catastrophic tipping points on these systems? The contents underpinning this

video is from Johan Rockström, whom I had the immense pleasure of meeting last year in Glasgow, as well as his colleague scientists.

1. Climate

The first boundary is **climate**.

For most of history of humanity, the level of carbon dioxide in Earth's atmosphere was about 277 parts per million (ppm). This means that for every million air particles, 277 of them were carbon dioxide molecules.

In the middle of the 19th century, that changed. Very quickly, the CO₂ level (the level of carbon dioxide in the atmosphere) began to rise.

By the 1910s, the CO₂ level had reached 300ppm.

We crossed from the safe zone into the danger zone in 1988, when we reached 350 parts per million of carbon dioxide in the earth's atmosphere.

In 2013, we surpassed 400 parts per million for the first time in human history.

And today, we are at 415 parts per million – which is right in the middle of the danger zone in the climate boundary. This amount of carbon dioxide in the atmosphere is the equivalent of 1.1 degree warming of the planet – as compared to when the Industrial Revolution of 1850 began (what we call a pre-industrial state).

If we reach the 450 parts per million mark, that is, that for every million air particles, 450 of those will be carbon dioxide molecules, we will exit the danger zone and enter a high risk zone. This 450 parts per million is equal to – you guessed it – the 1.5 degrees warming everyone is talking about.

In other words, we will start to trigger irreversible tipping points, where our planet will start to work against us by warming itself up even further.

We have two caps of permanent ice on our planet, Arctic and Antarctica, which help keep our climate stable. Ice reflects heat back from the sun. But as ice sheets melt and change, ice sheets can tip from becoming self cooling, to self warming; from reflecting heat back to absorbing it into the planet. This precipitates global warming. This is not even

mentioning the risks associated with how sea levels are rising as the ice caps are melting. For instance, the melting of the Greenland ice cap alone would raise sea levels around the world by 7 metres.

The next four planetary boundaries are **biosphere** boundaries: connected to those in and on the living Earth

2. Land configuration

The second planetary boundary relates to land configuration. This is about habitats that we have on earth: we have forests, rain forests, temperate forests, boreal forests, grasslands, wetlands.

We are changing the land configuration, for instance by cutting down trees to expand agricultural lands. Trees are also dying as a result of climate change – for instance, the Amazon tropical rainforest is undergoing a process of savannization linked to the increase in the dry season. In short, tropical rainforest trees are dying and being replaced by savanna.

When trees die, they release carbon into the atmosphere. So we need to keep the carbon in the forests. If we lose 25% of world's tree cover, we are risk of triggering catastrophic tipping points. But we have already cleared almost 40%.

We have crossed the safe planetary boundary and we are in danger zone for the land configuration (deforestation) planetary boundary.

3. Biodiversity

The third planetary boundary is about **biodiversity**, the species we have in nature. We are in a biodiversity crisis:

- In 50 years, we have wiped out 68% of global wildlife populations
- 1 million plants and animals, out of 8 million, are threatened with extinction

This is not only a threat to the plants and animals, but also to our lives as humans, in light of how much we rely on plants and animals for our own existence. In particular, the

expansion of intensive monoculture is leading to a decline in insects. But we need insects to grow our food. 70% of the world's crops rely to a certain extent on insect pollination. This is the food paradox: it is the global production of food worldwide that is wiping out what our food production relies on.

We have crossed the safe planetary boundary and we are in danger zone for the loss of biosphere integrity. Rockström and others speak about the 'Zero loss of nature' goal, to complement the 1.5 degrees goal.

We have crossed the safe planetary boundary and we are in danger zone for the land configuration (deforestation) planetary boundary.

4. Water

The fourth planetary boundary is **water**. We need fresh water every day to stay alive. We need it for hygiene and drinking, for washing and household uses. But the use we don't see is the water we use to grow food. People use on average around 3,000 litres of fresh water each every day. Only a small part of that goes to the obvious uses we think about (washing, drinking etc.). 2,500 of those litres are used to grow our food. We are still in the safe zone on fresh water but we are rapidly moving towards the danger zone.

5. Flow of nitrogen & phosphorus

The fifth planetary boundary relates to our overuse of **nutrients**: nitrogen and phosphorus. Nitrogen is taken out of the air, phosphorous is dug up out of the ground: both are nutrients that we add to fertilizers to increase the production of foods.

However, we are using too much fertilizer, and the unused nutrients are ending up in rivers and in oceans. Then a process called 'eutrophication' happens in the water that makes a lake with phosphorous in it even more phosphorous. This is harmful – for the water and marine species living in it.

We have crossed the safe planetary boundary and we are in the danger zone for the flow of nitrogen and phosphorus.

6. Oceans

The sixth planetary boundary relates to **oceans**. When we emit carbon dioxide into the atmosphere, one-third of this carbon dioxide ends up in the ocean. This in turn changes the chemistry of the ocean and is leading to ocean acidification. The ocean has become 26% more acidic over the past few decades, which in turn impacts those marine species living in the ocean. We are in the safe zone, but pushing towards the danger zone for this planetary boundary of ocean acidification.

I'll go more quickly now through the remaining three.

7. Novel Entities

The seventh planetary boundary is about **human-made pollutants**, known as **novel entities**. These are all of the new materials we create that can interact with the environment (microplastics, nuclear waste, organic pollutants, etc.). These polluting substances have the potential for planet-wide disruption.

8. Aerosols

The eighth planetary boundary is about **air pollution**. **Aerosols** are particles in the atmosphere, 75% come from fossil fuel combustion. This air pollution is masking the full effect of global warming, which is risky because we are not seeing the full effect of greenhouse gases. This air pollution kills over 7 million people every year and takes 3 years of life expectancy off our lives.

9. Ozone Layer

The ninth planetary boundary is about the **ozone layer**. The ozone layer intercepts harmful ultraviolet radiation to protect us, it acts like a sort of sunscreen for the world. Chemical pollutants, known as CFCs, led to a hole in the ozone layer, above the South Pole, over Antarctica. When we found this out in the 1980s, the world reacted by phasing out the CFCs. This meant that we stopped using certain deodorants, hair sprays, fridges, and fire extinguishers. These actions, coordinated through the 1987 Montreal Protocol, is a success story: we went into a high risk zone and we returned back into a safe space.

Three takeaways for companies

First, your company's work on carbon is important, and your company's net zero target is a critical part of helping ensure we do not cross into dangerous tipping points. Staying within 1.5 degrees of warming is the only way to guarantee this. In addition, your company's work on greenhouse gas emissions will impact other boundaries: consider for instance how an increase in carbon dioxide in the atmosphere increases ocean acidification (another boundary), which in turn impacts marine species and biodiversity (another boundary).

Second, there are other aspects beyond climate that are important to consider as well. The planetary boundaries identified by Johan Rockström and Will Steffen can act as a checklist of sorts as you consider your company's environmental footprint:

- **Land:** What is your company doing when it comes to **land use and deforestation** – both in its own operations, as well as in its supply chain?
- **Biodiversity:** What is your company doing when it comes to **biodiversity** – both in its own operations, as well as in its supply chain?
- **Water:** What is your company doing when it comes to **use of water** – both in its own operations, as well as in its supply chain?
- **Nutrients:** Does your company (or its supply chain) rely on **nitrogen or phosphorus** in its products?
- **Human-made materials:** Does your company (or its supply chain) produce and/or rely on **human-made materials**?
- **Aerosols:** Does your company (or its supply chain)'s activities produce **particles in the atmosphere** – aerosols?

Third, positive change is possible, and it is urgent.

We have exceeded four of the nine boundaries that relate to climate, forests and land, biodiversity and nutrients.

This is very risky, because if we cross irreversible tipping points, we could push our planet into an unstable state that could no longer support humanity as we know it. However we also know from the last planetary boundary related to the ozone layer, that it is possible to come back from danger – so long as meaningful coordinated action takes place.

This is the only way forward.

Thank you for watching, and see you soon.

For sources and further information, please see:

- Stockholm Resilience Centre, The nine planetary boundaries, available at <https://www.stockholmresilience.org/research/planetary-boundaries/the-nine-planetary-boundaries.html>
- Stockholm Resilience Centre, Planetary Boundaries - an update (2015), available at <https://www.stockholmresilience.org/research/research-news/2015-01-15-planetary-boundaries---an-update.html>
- Breaking Boundaries: The Science of our Planet (Netflix documentary with David Attenborough and scientist Johan Rockström), <https://www.netflix.com/gb/title/81336476>