

Livestock within Planetary Boundaries



Dr. Nitya Sambamurti Ghotge

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What are planetary boundaries?

- *In 2009, Johan Rockström a scientist and sustainability expert led a group of 28 internationally renowned scientists to identify 9 key processes that regulate the stability and resilience of our planet. They proposed quantitative 'planetary boundaries' within which humanity can continue to develop and thrive for generations to come.*
- *Crossing these boundaries increases the risk of generating large-scale abrupt or irreversible environmental changes.*

Planetary boundaries are essentially the preconditions for human development.

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Rockström, J., W. Steffen, K. Noone, Å. Persson, F. S. Chapin, III, E. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. Schellnhuber, B. Nykvist, C. A. De Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. Foley. 2009. Planetary boundaries: exploring the safe operating space for humanity. *Ecology and Society* 14(2): 32. [online] URL: <http://www.ecologyandsociety.org/vol14/iss2/art32/>



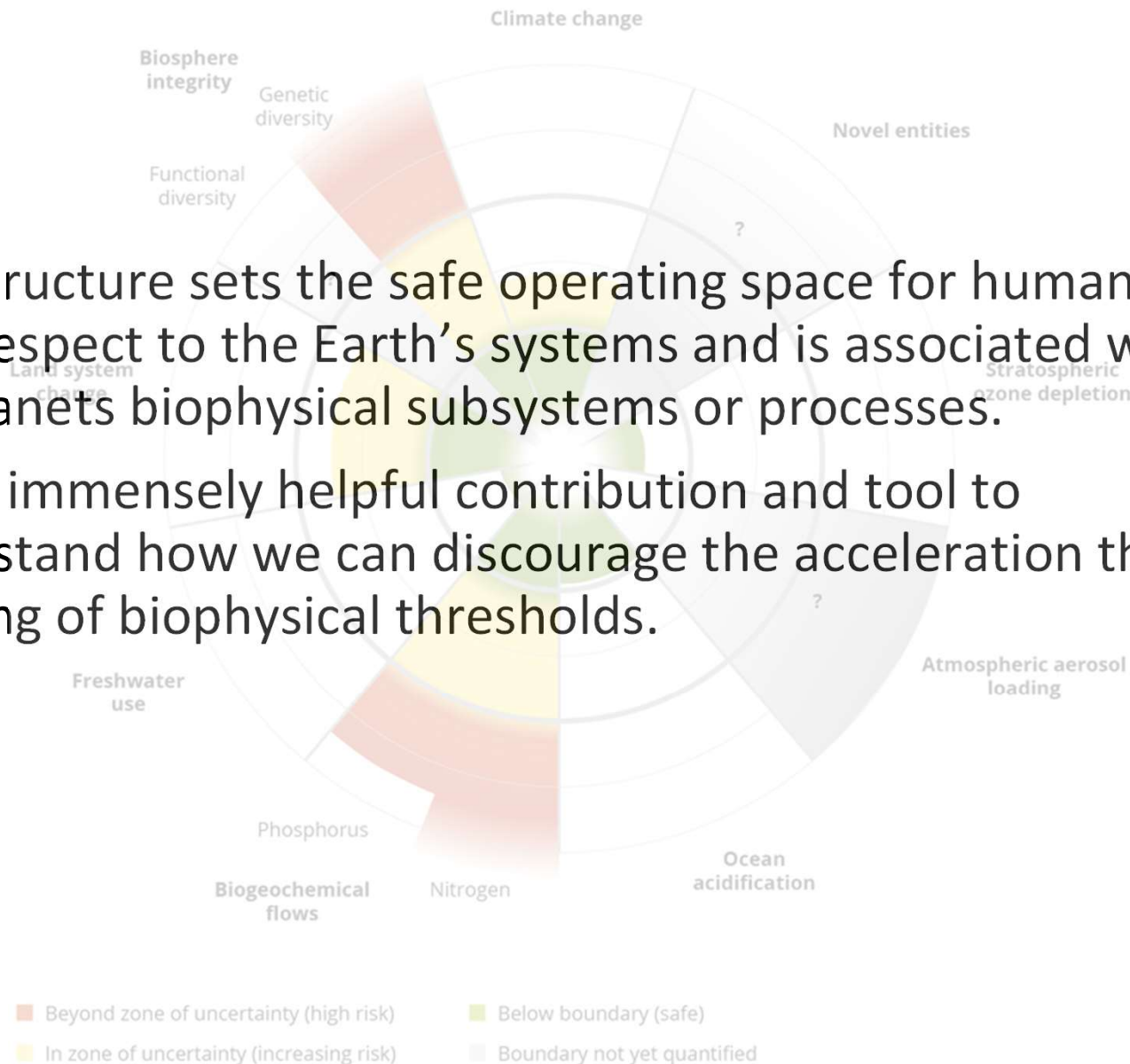
Research

Planetary Boundaries: Exploring the Safe Operating Space for Humanity

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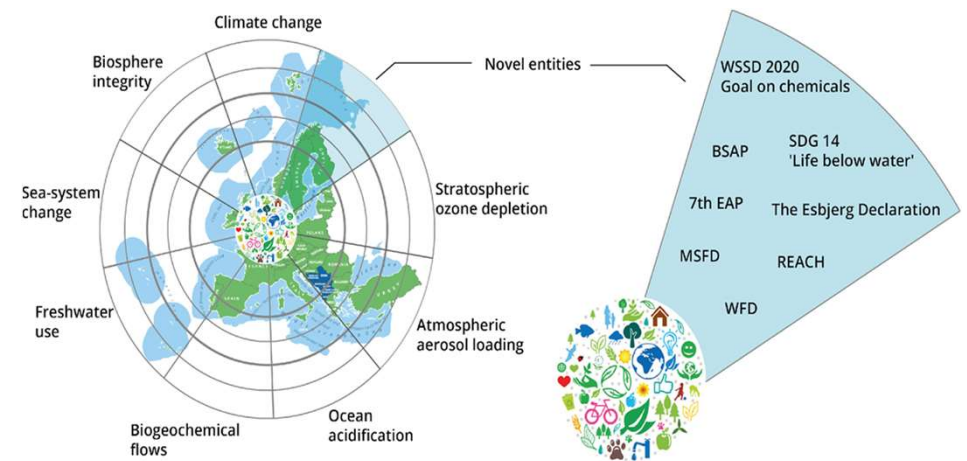
ABSTRACT. Anthropogenic pressures on the Earth System have reached a scale where abrupt global environmental change can no longer be excluded. We propose a new approach to global sustainability in which we define planetary boundaries within which we expect that humanity can operate safely. Transgressing 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

- This structure sets the safe operating space for humanity with respect to the Earth's systems and is associated with the planet's biophysical subsystems or processes.
- It's an immensely helpful contribution and tool to understand how we can discourage the acceleration the crossing of biophysical thresholds.

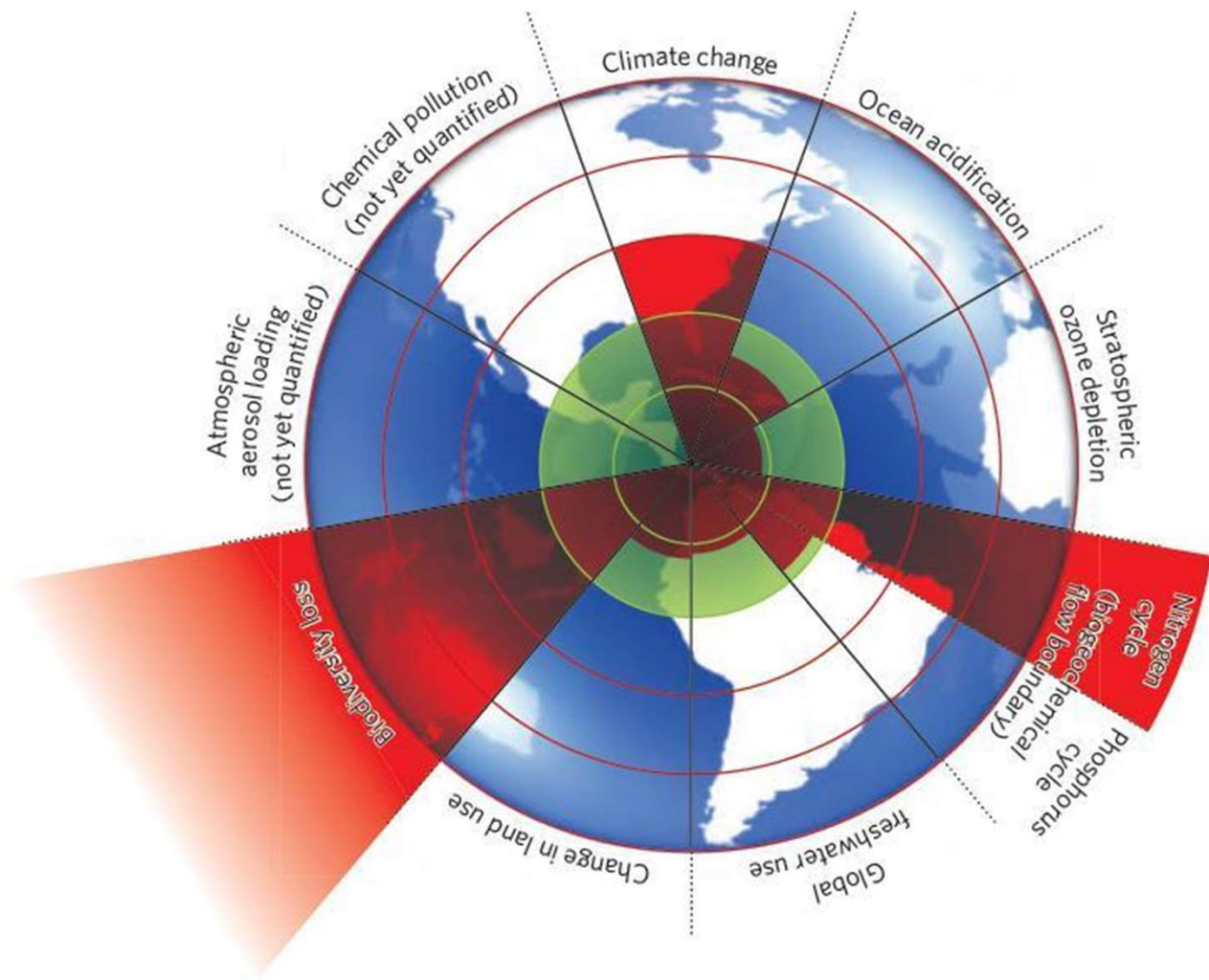


The concept of planetary boundaries has 9 linear, delicately interconnected specific conditions:

- **1. Climate change**
- **2. Rate of biodiversity loss (terrestrial and marine)**
- **3. Interference with nitrogen/phosphorus cycles**
- **4. Stratospheric ozone depletion**
- **5. Ocean acidification**
- **6. Global fresh water use**
- **7. Change in land use**
- **8. Chemical pollution**
- **9. Atmospheric aerosol loading**

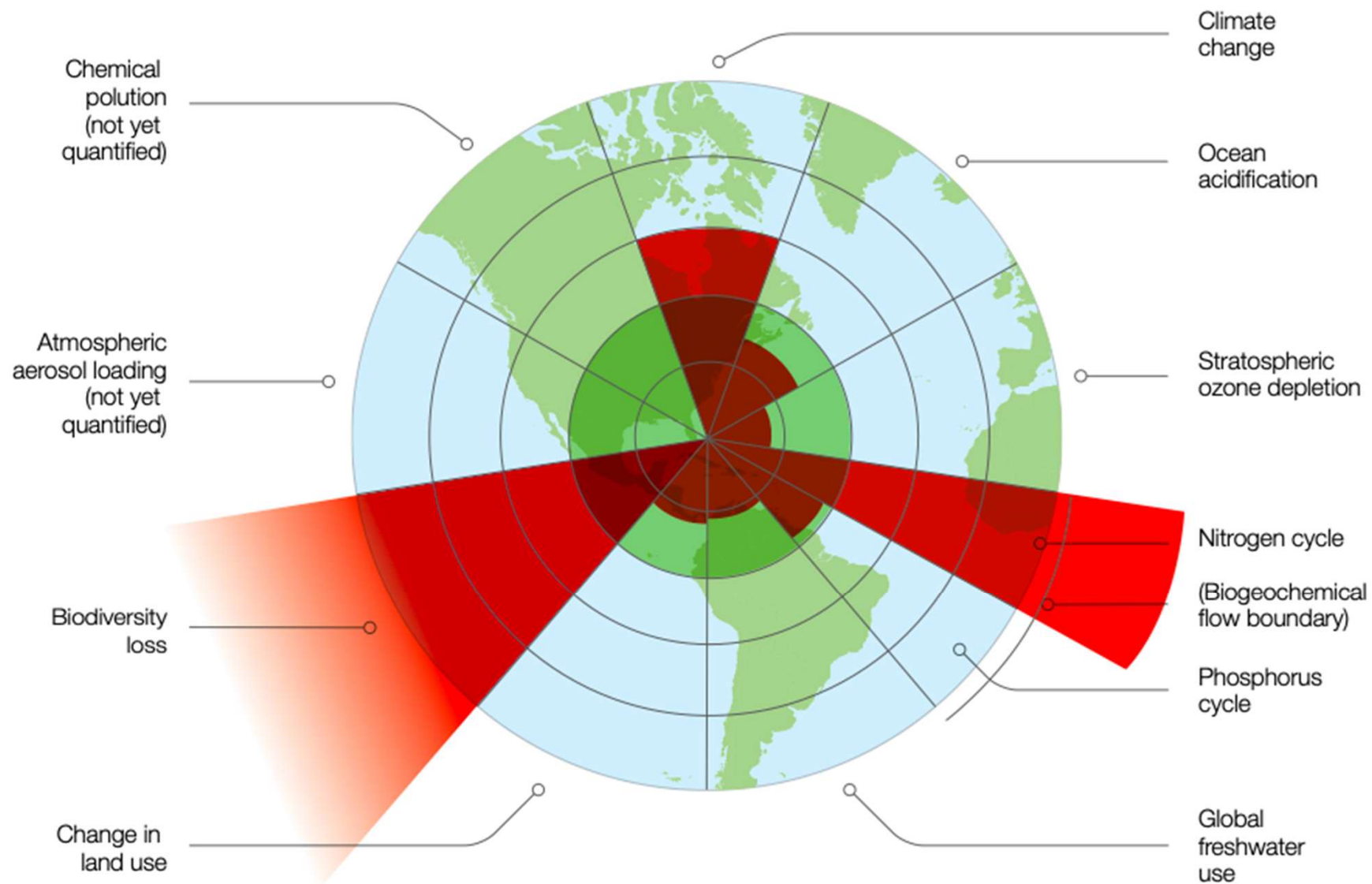


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As of 2020, we had crossed the first three thresholds

- For those wondering, the consequences of surpassing all nine planetary boundaries holds irreversible repercussions for the planet and future generations. As we overstep each threshold and boundary, it subsequently jeopardises the rest.
- For example, land use changes in the Amazon can immediately impact fresh water sources in faraway lands. Additionally, the extent climate change as a planetary boundary is violated depends on our ability to maintain freshwater, land, aerosol, nitrogen, phosphorous, ocean systems and stratospheric boundaries. This interlinking means exceeding one has an impact, we are still not yet aware of.



Livestock production and Planetary boundaries

- The main impacts of livestock production are key components in four of those boundaries – **biodiversity loss**, **nitrogen** and phosphorus cycles, **land use change** and **climate change**
- As of 2000, the livestock sector had already occupied a large fraction of the safe operating space of the planet's resources (Pelletier & Tyedmers 2010):
- 72% of safe operating space available for the productivity of all vegetation on Earth, thus affecting biodiversity loss and land use at large;
- 117% of the safe operating space for reactive nitrogen mobilisation; and
- 52% of the safe operating space for human-induced climate change gases.

The livestock sector and planetary boundaries: A 'limits to growth' perspective with dietary implications

The livestock sector is a key driver of humanity's transgression of several planetary boundaries, with the production of ruminant meat being particularly impactful.

Given current trends in demand for animal products, strategies to significantly reduce the livestock sector's environmental impacts are urgently needed.

The paper draws on published data to examine livestock's impacts in three key critical [sustainability](#) domains within the planetary boundaries framework – climate change, biochemical flows and land-system change, and seek to quantify livestock's occupation of humanity's safe operating space now and into the future (2050).

They estimate that the livestock sector may already occupy the majority of, or transgress, humanity's safe operating space across these domains, with such impacts forecast to grow by 2050.

The implication of these findings is that [macroeconomic policies](#) promoting both sustainable production and consumption practices are integral to the realisation of a sustainable food system, where humanity functions within its safe operating space.

- With constraints on feed resource availability, it is envisaged that remaining livestock production would largely emanate from those production systems that draw heavily on “ecological leftovers” (Garnett et al., 2017), or low opportunity cost resources.
- This includes food wastes, crop residues and non-arable land resources that are unsuitable for growing crops or establishing forests (Garnett et al., 2017; Schader et al., 2015; Van Zanten et al., 2018). This strategy would involve livestock shifting back to their more traditional role within the food system as “default land user(s)”



Chapter

Livestock and the boundaries of our planet

By Katherine Richardson

Book [Farming, Food and Nature](#)

Edition	1st Edition
First Published	2018
Imprint	Routledge
Pages	4
eBook ISBN	9781351011013



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ABSTRACT

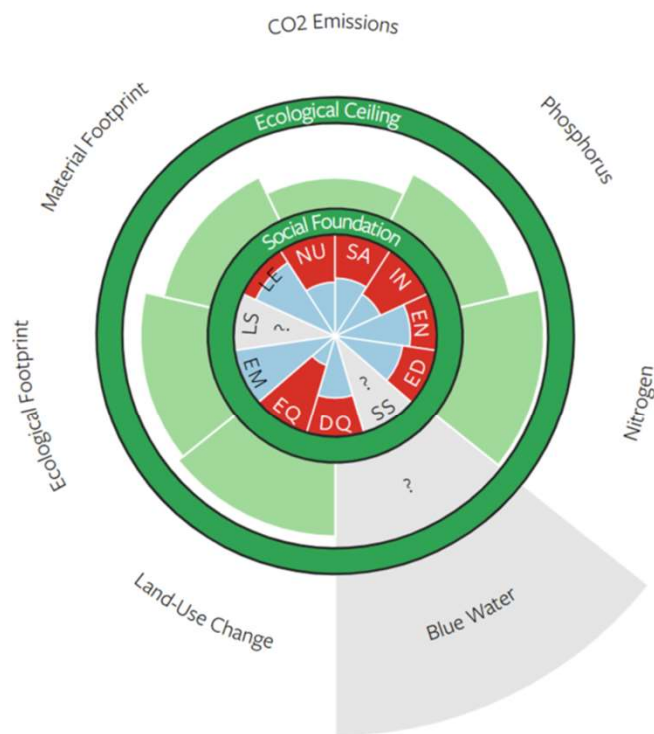
As our understanding of Earth System functioning has evolved, it has become clear that farming – and not least of which, livestock production – has an enormous effect on the planet. Through the study of the Earth as a system (“Earth System science”), critical resources can be identified and estimates of their availability developed. One approach for doing this is the planetary boundaries framework. We have crossed four of the nine boundaries: climate, biosphere integrity (biodiversity), land use (felling of forest) and the release of reactive nitrogen and phosphorous to the environment. Developments in the understanding of impacts of agricultural activities on Earth system processes strengthen Compassion’s call for a major transformation of the industrialised agricultural system.

“A good life for all within planetary boundaries”

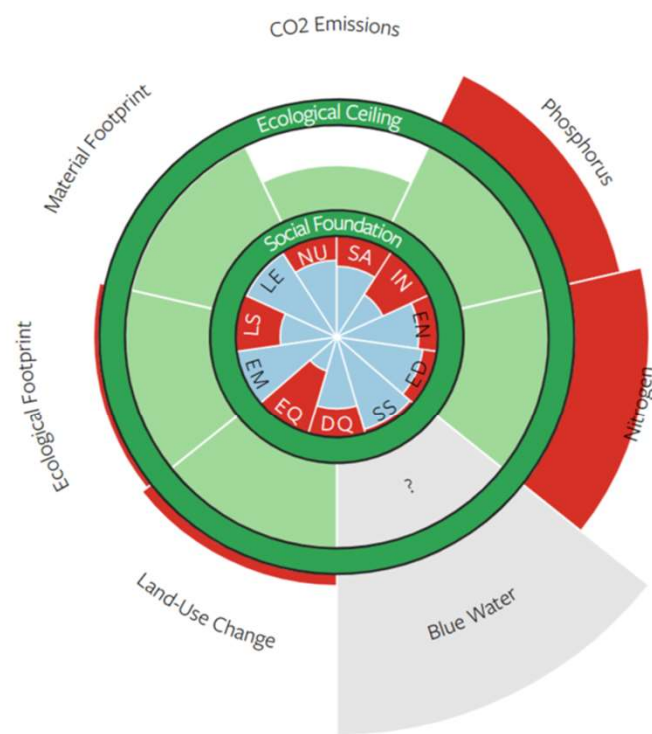
- Humanity faces the challenge of how to achieve a high quality of life for over 7 billion people without destabilizing critical planetary processes. Using indicators designed to measure a ‘safe and just’ development space, the authors quantified the resource use associated with meeting basic human needs, and compared this to downscaled planetary boundaries for over 150 nations.
- The found that no country meets basic needs for its citizens at a globally sustainable level of resource use.
- Physical needs such as nutrition, sanitation, access to electricity and the elimination of extreme poverty could likely be met for all people without transgressing planetary boundaries.
- However, the universal achievement of more qualitative goals (for example, high life satisfaction) would require a level of resource use that is 2–6 times the sustainable level, based on current relationships. Strategies to improve physical and social provisioning systems, with a focus on sufficiency and equity, have the potential to move nations towards sustainability, but the challenge remains substantial.

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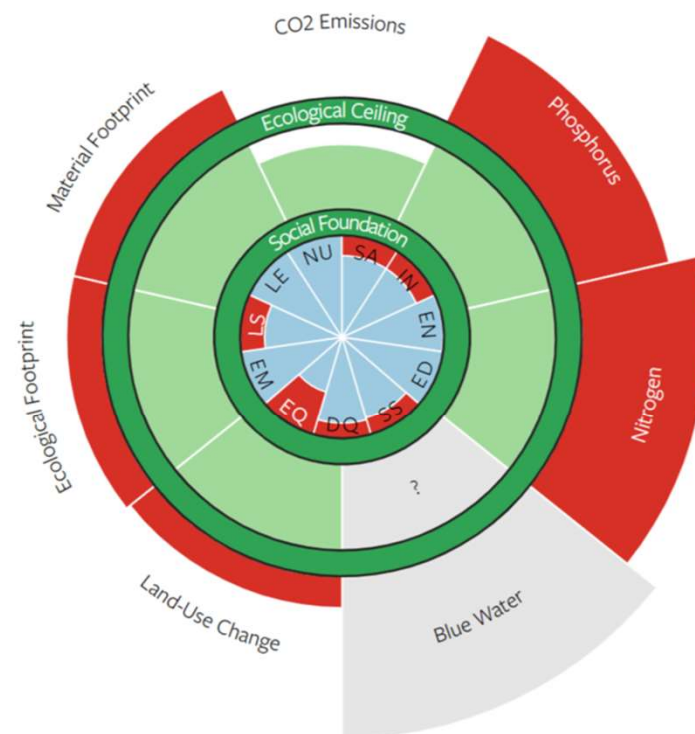
1992



2005



2015

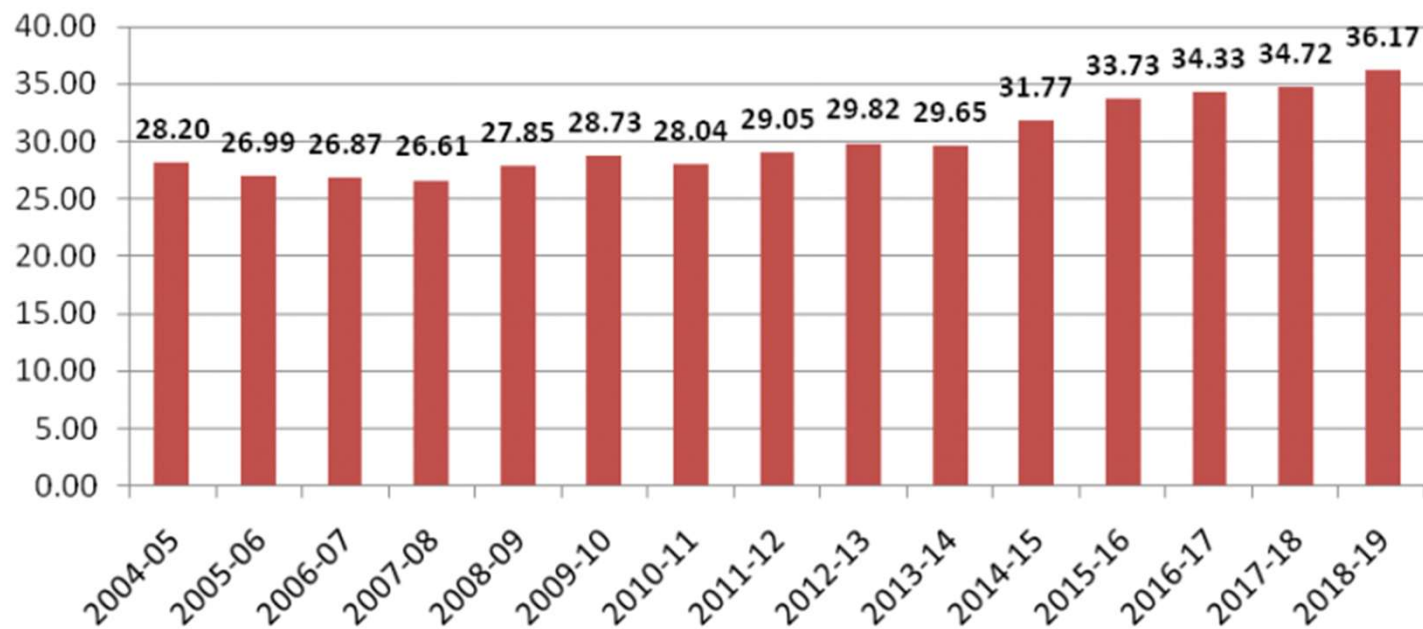


<https://goodlife.leeds.ac.uk/national-snapshots/countries/#Netherlands>

There are some who are more optimistic

- On ereport says that
- “if we are able to keep in check the remaining thresholds there is no reason we cannot pursue long term social and economic development. Such a trajectory is outlined by the United Nations through the clear agenda of the [2030 Sustainable Development Goals](#) to address these challenges”

Chart 1
Livestock as % of Agriculture Production
(All-India value at current prices)



Source: National Accounts Statistic

Today India is considered the largest milk producer in the world .

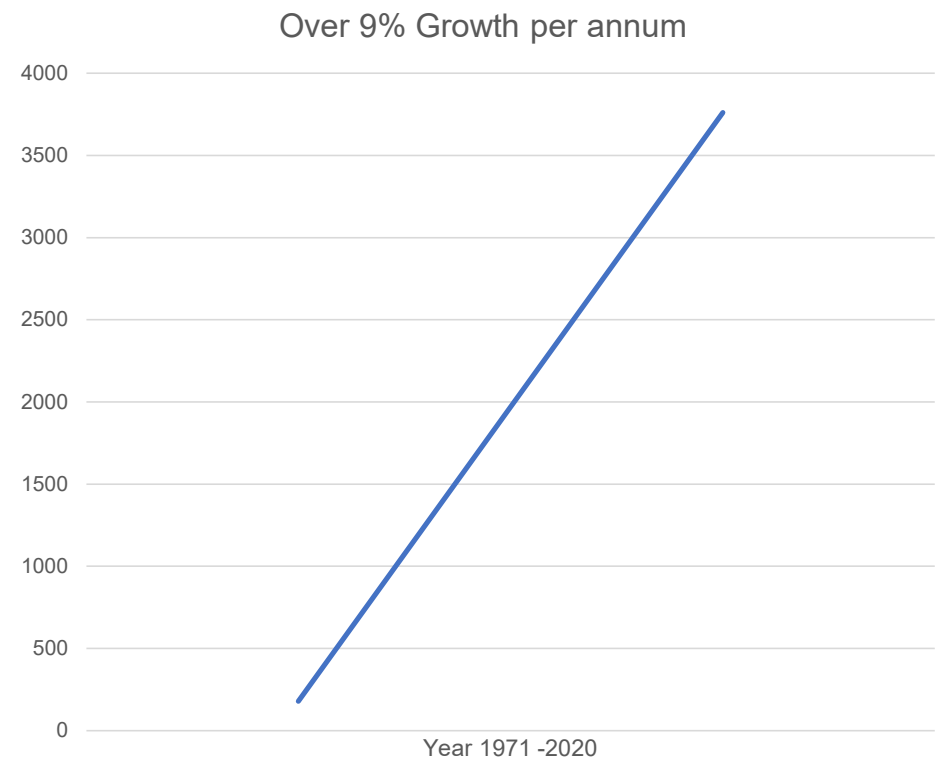
The Indian dairy market size reached a value of nearly USD 144.55 billion in 2020. The Indian dairy market is expected to grow at a CAGR of around 6% in the forecast period of 2021-2026.

Source FICCI



Growth in Meat production

In 2020, production of buffalo meat for India was 3,760 thousand tonnes. Production of buffalo meat of India increased from 179 thousand tonnes in 1971 to 3,760 thousand tonnes in 2020 growing at an average annual rate of 9.62%. (Knoema)



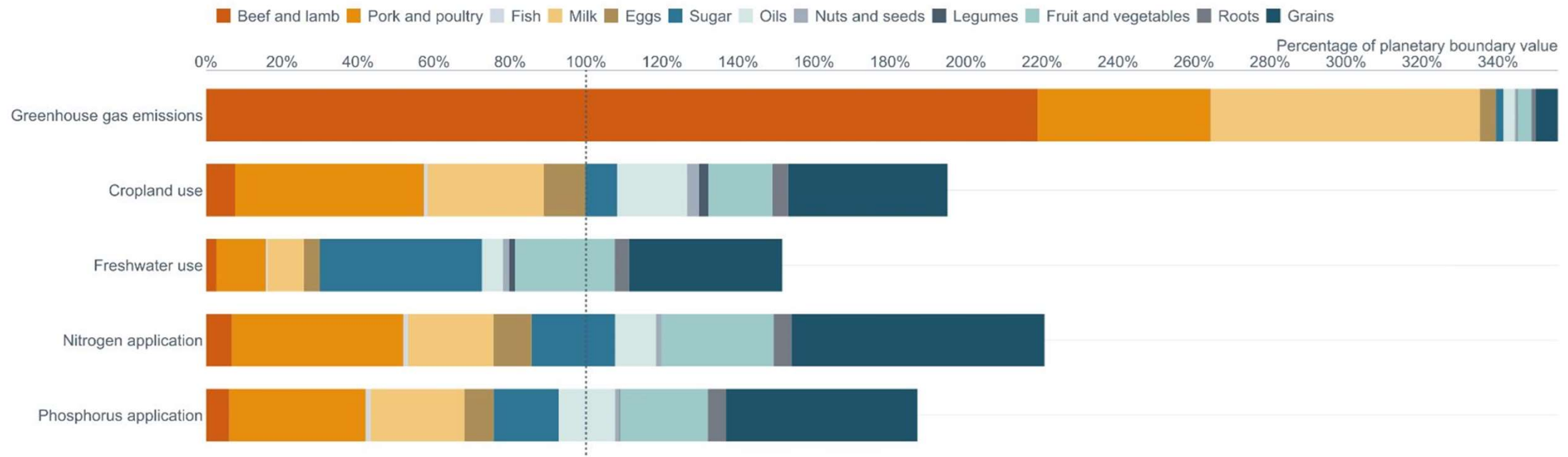
An exponentially growing Poultry sector

- Egg production has been rising steadily from 2005.
- from 95 billion in 2017-18 to 105 billion the following year and to 114 billion in 2019-20.
- In fiscal year 2020, the production of eggs across India amounted to over 114 billion, a significant increase from about 16 billion eggs produced in fiscal year 1986.
- Similarly, poultry meat production, too, has been expanding. From 3.7 ml t in 2017-18 it grew to 4.1 ml t the following year, and then on to 4.3 ml t in 2019-20



Is this Sustainable ?

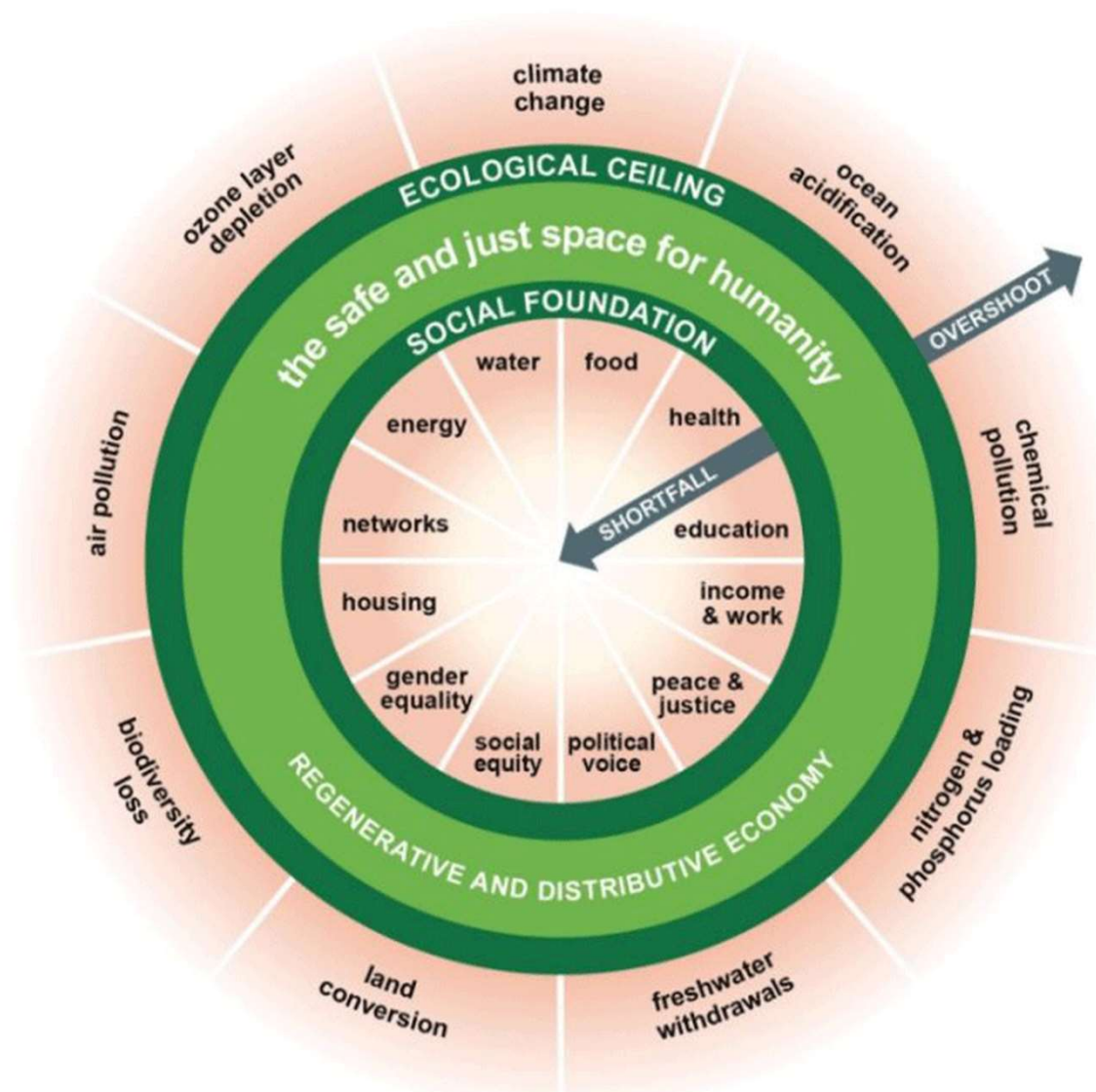
Food system impact on planetary boundaries



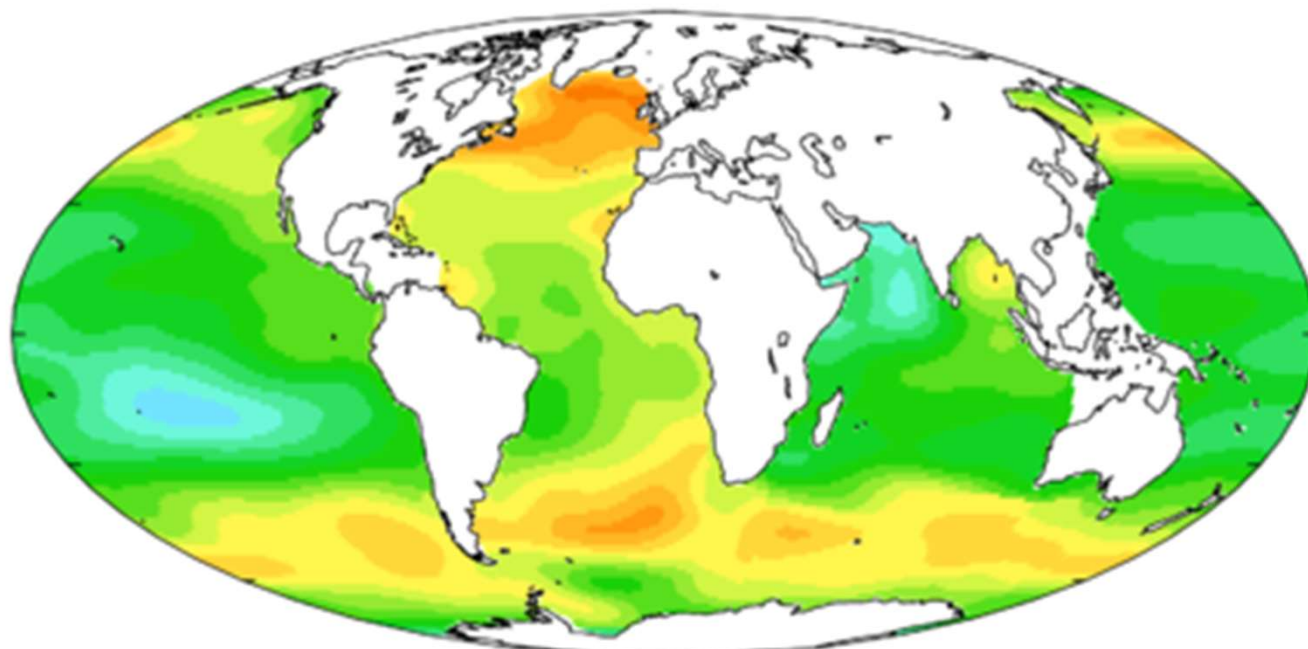
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Catherine Pfeifer Davos, 2. September 2021, EAAP Conference
Challenges and novel metrics of multi objective tools session 67

Thank you

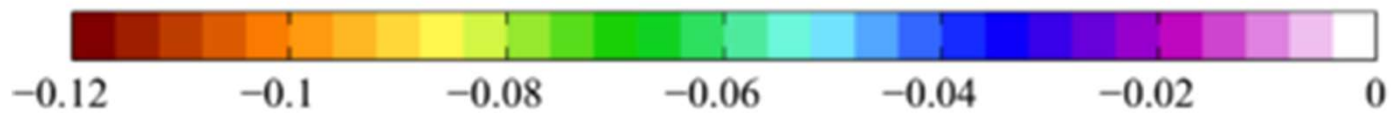


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Δ sea-surface pH [-]





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