Assessing Planetary Boundary Transgressions and Their Causes Using the FRIDA System Dynamics Model

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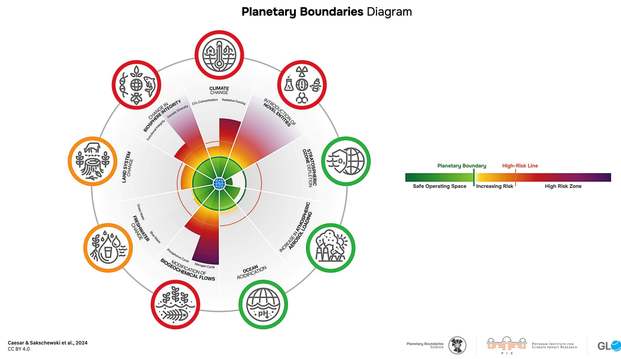
1. Planetary boundaries (PBs)

The PBs framework defines a "safe operating space" based on nine key Earth system processes.

We use the system dynamics model FRIDA to explore:

1) The five PBs biosphere integrity, land system change, freshwater use; biogeochemical flows and climate change.
2) The agricultural drivers of their transgressions; and
3) Their interactions.

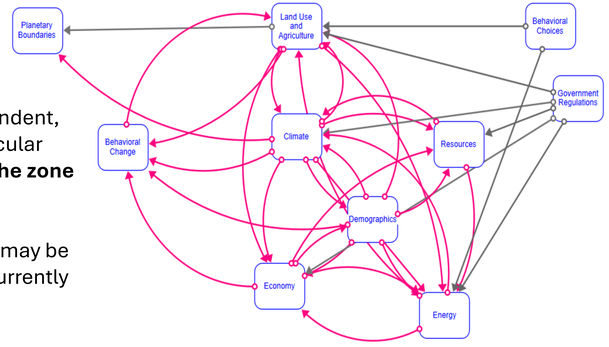


2. PBs in an integrated model

FRIDA simulates PB developments over time. These have been validated against documented values.

The results show strong agreement with independent, earlier, estimates of PB trajectories and in particular whether PBs are in **the safe operating space, the zone of increasing risk** or **the high-risk zone.**

Yet, there are some notable differences, which may be attributed to for some relevant processes not currently represented in FRIDA.



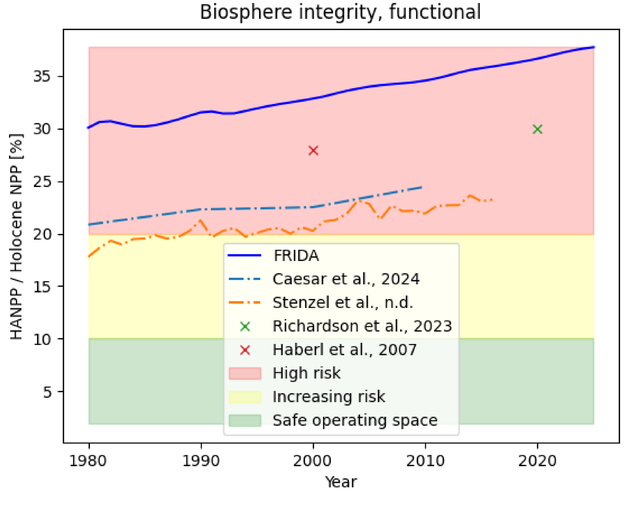
3. Conclusion:

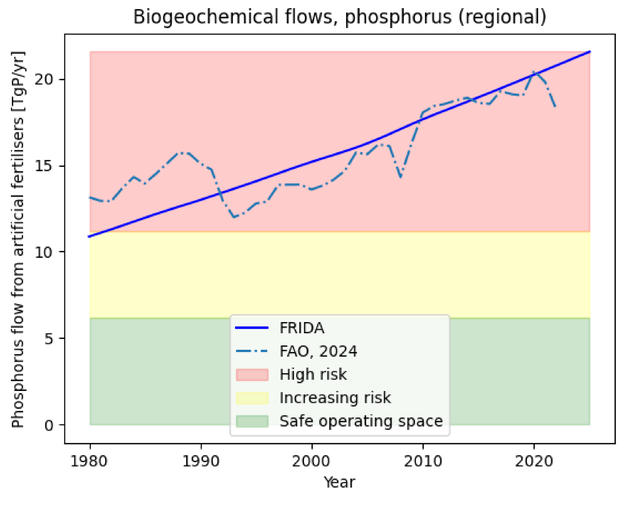
FRIDA simulates PB trajectories, their drivers and interactions based on suitable assumptions.

The calculation of PB statuses has supported the model development by providing time series with comparable results in the literature for validation.

Future studies could potentially implement all PB control variables using FRIDA, ideally in a more spatially explicit manner and with more processes represented (see 2. PBs in an integrated model)

Representation of all nine PBs might contribute towards addressing the research gap in quantifying the drivers and interactions of PBs.





Judging OSPP contest

Literature

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