Towards meaningful consumption-based planetary boundary indicators: The phosphorus exceedance footprint

Topic: Planetary Boundaries and IOA
Author: Mo Li
Co-Authors: Thomas O. WIEDMANN

Abstract

The idea of measuring humanityâ€™s footprint against planetary boundaries has attracted wide academic attention but methods to implement the theory in sustainability accounting remain underexplored. To help nations take collective actions to stay within a safe operating space, footprinting approaches need to be revised to accommodate biophysical limits. Here we develop a novel sustainability indicator, the phosphorus exceedance footprint (PEF) that measures countriesâ€™ contributions to the transgression of the planetary boundaries for phosphorus. Adopting a consumption-based perspective reveals how nations contribute to environmentally unsustainable phosphorus pollution in their trading partners. This captures country-specific transgression through supply chains in a way that complements conventional footprinting. In 2011, 27% of the worldâ€™s PEF was associated with international trade flows. Wealthier countries tend to reduce their domestic phosphorus fertiliser exceedance, thus preserving their own natural environment, while increasing their share of imported P-embodied products through trade. A pattern of highly uneven distribution of phosphorus-compromised economies is revealed, with 76% of the worldwide exceeded phosphorus embodied in exports supplied by only four countries: China (42%), Brazil (19%), India (10%) and New Zealand (5%). All countries transgress phosphorus planetary boundaries, even those that do not exceed their own territorial boundaries. Our findings highlight that mitigation strategies need to include international cooperation on increasing the efficiency of fertiliser use and reducing the demand of products that cause phosphorus exceedance.

Key words: planetary boundary transgression; exceedance footprint; global multi-region input-output analysis; phosphorus; globalisation; trade

RQ: How global P boundaries are exceeded by consumption at local levels?

Method: Consumption-based accounting

Data used: GTAP-MRIO + FAO data + PB theory

Novelty: To our knowledge this is the first attempt to apply the exceedance footprint concept using downscaled national planetary boundaries as a benchmark, providing a global assessment of how these boundaries are exceeded by consumption elsewhere. Our paper opens up a potentially new field of 'Exceedance footprint'.

This is the first empirical paper that combines absolute sustainability, local PB boundaries and footprint into one paper.