

Does consumption in the Republic of Ireland respect planetary boundaries?

Research InBrief No. 78

July 2021

Paul Goldrick-Kelly

Summary:

Humanity faces a key and potentially existential challenge: namely, how to satisfy human needs and other goals without disrupting key planetary processes. This *InBrief* compares consumption in the Republic of Ireland to a number of global boundaries (adjusted per person) which represent estimates of equitable and safe operating space for humanity. The analysis concludes that consumption in ROI exceeds planetary boundaries in six of seven cases, often by significant margins. Consumption will have to change significantly if activity in Ireland is to respect biophysical limits.

Introduction

Recent work from Rockstrom et al (2009) and Steffen et al. (2015) has identified a number of crucial planetary boundaries for the planet's biosphere. Their work identifies nine (of which 7 are measured) such boundaries which set the limits for "safe operating space" to maintain the historically stable conditions to which human civilisation is accustomed. Their research concludes that five of the seven measured boundaries have been transgressed in the areas of atmospheric CO₂ tied to climate change, species loss, changes in land-systems and Nitrogen and Phosphorus cycles.

This *InBrief* uses the framework developed by O'Neill and colleagues (2018) to examine the link between social performance and resource use related to these boundaries. As they point out in their work, many wealthier countries are relatively successful in terms of basic social indicators but significantly exceed safe planetary operating space. Thus, we should note unequal contributions to the transgression of planetary boundaries across and within countries. This study focuses on measures of the ecological impact of consumption in the

Republic of Ireland relative to adjusted measures of safe operating space per person used by O'Neill et al. (2018).

Boundaries

O'Neill et al. (2018) examines resource use over five biophysical categories from the planetary boundaries framework - *climate change*, *freshwater use*, *Nitrogen loading* and *Phosphorus loading* – alongside two common indicators of environmental impact in the form of *ecological* and *material footprint*. These indicators are calculated in consumption based terms – in the Republic of Ireland, this amounts to the ecological impact of the consumption of goods and services within the territory rather than by whether or not production occurred within ROI.

Table 1 presents the thresholds used, alongside their adjusted per capita boundary for 2015, the latest year for which we had relatively complete data for ROI. The boundary data assume an equal right to the use of planetary resources, and thus reflect the global annual boundary divided by some 2015's global population of 7.3 billion.

The ROI *CO₂ emissions* data used reflect consumption based allocation of emissions. This is compared to the annual per capita carbon budget remaining according to the IPCC (2018) to limit warming to 1.5 ° C by 2100. The data are adjusted to reflect the remaining budget in 2015, which, it should be noted has been reduced by subsequent years of global emissions. The *Phosphorus* and *Nitrogen loading* boundaries refer to safe operating spaces which do not substantially damage marine habitats (Steffen et al. 2015). This is compared to national consumption based allocations of Phosphorus and Nitrogen from applied fertilizers.

The “embodied human appropriation of net primary production” (eHANPP) measures biomass harvested through agriculture and forestry alongside biomass lost or killed and not used in harvests or through change in the use of land. Running (2012) notes that this integrates four of Steffen et al.'s (2015) boundaries: land-system change and changes in the integrity of the biosphere (which includes factors like biodiversity and the biosphere's role in earth systems), alongside links to freshwater use and biogeochemical systems. Irish *land-use change* data relate to estimates of 2007 eHANPP consumption, the latest data available.

Freshwater use refers to maximum permissible withdrawal of blue water from lakes, rivers and other water stores. This is measured for the ROI by consumption of surface reservoirs, or blue water use. The *material footprint* measure materials extracted for goods and services on a consumption basis, measuring consumption from mineral, fossil fuels and biomass for ROI. The *ecological footprint* measures the amount of biologically productive land/sea are required to produce the biotic resources consumed by a population, alongside the resources required to absorb generated emissions with current technologies.

Table 1: Planetary boundaries

Boundary	Measure	Annual adjusted per capita boundary (2015)	ROI data source
Climate change	CO ₂ emissions*	0.81 tonnes of CO ₂ eq	Eora MRIO database
Land-use change	eHANPP	2.48 tonnes of dry matter	Kastner et al. (2015)
Freshwater use	Blue water use	545 metres ³	Eora MRIO database
Phosphorus loading	Consumption based allocation of Phosphorus	0.84 kg	Eora MRIO database
Nitrogen loading	Consumption based allocation of Nitrogen	8.45 kg	Eora MRIO database
Ecological footprint	Global hectares	1.64 global hectares	Global Footprint Network
Material footprint	Allocation of used raw material extraction	6.81 tonnes	Eora MRIO database

Source: O'Neill et al. (2018), World Bank (2021), IPCC (2018)

Note: Adjusted boundaries reflect aggregate boundaries described in O'Neill et al. (2018) adjusted to reflect the global population in 2015 – the latest year for which we have consumption data for ROI. *This boundary reflects the available per capita (based on 2015 population) budget on an annual basis to 2100, or the 1/85th the remaining budget.

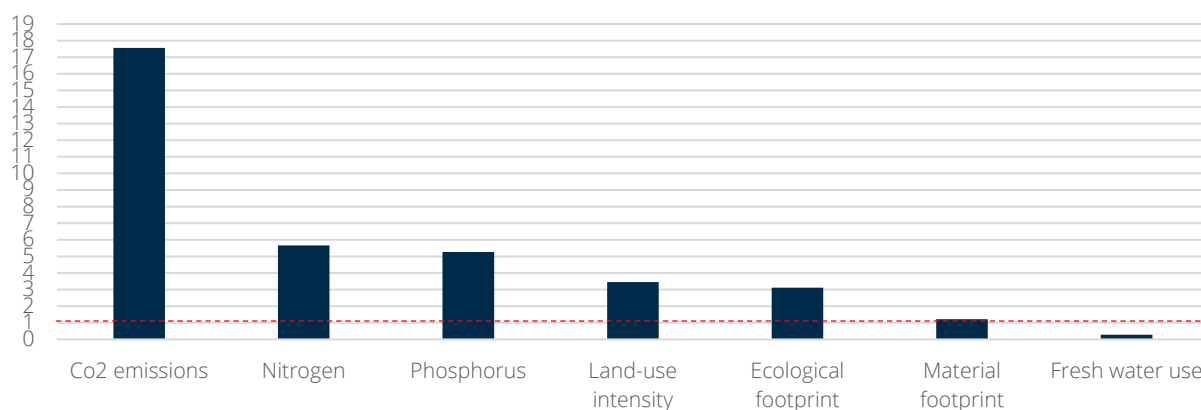
Results

Figure 1 demonstrates that per capita, consumption based measures of resource use and environmental impact in Ireland exceeded safe operating space six of seven boundaries. In many cases, boundaries were exceeded by many multiples. This is particularly true of consumption based emissions, which at approximately 14.35 tonnes per person in 2015, exceeded annual budgets by more than 17 times. Nitrogen and Phosphorus use in fertilisers (47.82 kg and 4.45 kg) exceeded the calculated per capita operating space by more than 5 times. ROI's *ecological footprint* and *land-use change* were over 3 times their boundaries at 5.12 global hectares and 8.56 tonnes of dry matter in 2015. While Ireland's relative endowment of resources is high according to the global footprint network (2021), it has been

exceeding its biocapacity since the late 1960s, exceeding national capacity by approximately 50 per cent in 2015.

Ireland's overshoot in *material footprint* terms is modest in relation to other measures, but still substantial at over 21 per cent (8.45 tonnes). Fresh water is the only boundary not transgressed by consumption in ROI, at some 155 metres³ or under 30 per cent of the global boundary.

Figure 1: ROI per capita consumption relative to respective boundary (=1)



Sources: See Table 1 above

Conclusion

Consumption in the Republic of Ireland exceeded adjusted per person planetary boundaries in six of seven measured domains. Going by this analysis, consumption and its associated environmental impacts will have to be the target of sustained and significant change to operate within a safe space for the biosphere.

References

- EORA (2021) MRIO database
- Global Footprint Network (2021) National footprint and biocapacity accounts.
- IPCC (2018) Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty
- Global human appropriation of net primary production for biomass consumption in the European Union, 1986–2007. *Journal of Industrial Ecology*, 19(5), 825-836.
- O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018). A good life for all within planetary boundaries. *Nature sustainability*, 1(2), 88-95.
- Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F. S., Lambin, E. F., ... & Foley, J. A. (2009). A safe operating space for humanity. *nature*, 461(7263), 472-475.
- Running, S. W. (2012). A measurable planetary boundary for the biosphere. *science*, 337(6101), 1458-1459.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., ... & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223).

World Bank (2021) World Bank open data