

Towards a comprehensive framework of the relationships between resource footprints, quality of life and economic development

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Supplementary Information 2

Analysis of Resource Footprint components

In this supplementary analysis, Resource Footprints (RFs) are disaggregated into their major components. In addition to MF and CF, also Land Footprints (LF) and Water Footprints (WF) will be assessed, each set into relation with the HDI as an approximation for QL. The MF consists of biomass, metal ores, minerals and fossils; the CF of carbon dioxide, methane, nitrous oxide and other GHGs; the LF of pasture, crops and forest; the WF of green water, blue water and grey water. This analysis shows, which of the RF components can reasonably be added to a framework based on the overall regression results, and which environmental pressures should rather be treated separately. Table S 2.1 provides the detailed results, for data see Sheet 6 in [1], Figure S 2.1 provides a visualisation for MF and CF.

According to the analysis of RF components explained by QL (Table S 2.1, results visualized in Figure S 2.1), fossil fuels, carbon dioxide and minerals are the components showing the strongest correlation with the respective model (logarithmic for HDI and HI, linear for GDP/cap, according to the results in Section 3.1.). This points to the high resource dependency of the energy and construction sectors, which account for large shares of these footprints.

Table S 2.1: Correlations (β -coeff, Pearson) of resource footprint components with HDI, HI and GDP/cap

		HDI (log) <i>N</i> =168	HI (log) <i>N</i> =154	GDP/cap (linear) <i>N</i> =166
MF (06-15 avg)	<i>Metals</i>	.758**	.656**	.483**
	<i>Minerals</i>	.830**	.637**	.760**
	<i>Fossils</i>	.909**	.732**	.734**
	<i>Biomass</i>	.656**	.626**	.607**
CF (06-15 avg)	<i>CO2</i>	.841**	.728**	.889**
	<i>CH4</i>	.645**	.563**	.771**
	<i>N2O</i>	.622**	.549**	.496**
	<i>other GHG</i>	.882**	.740**	.407**
LF (06-15 avg)	<i>Pasture</i>	.349**	.325**	.100
	<i>Crops</i>	.561**	.478**	.485**
	<i>Forestry</i>	.535**	.407**	.233**
WF (96-05 avg)	<i>Green</i>	.239**	<i>no data</i>	.242**
	<i>Blue</i>	.531**	<i>no data</i>	.339**
	<i>Grey</i>	.870**	<i>no data</i>	.604**

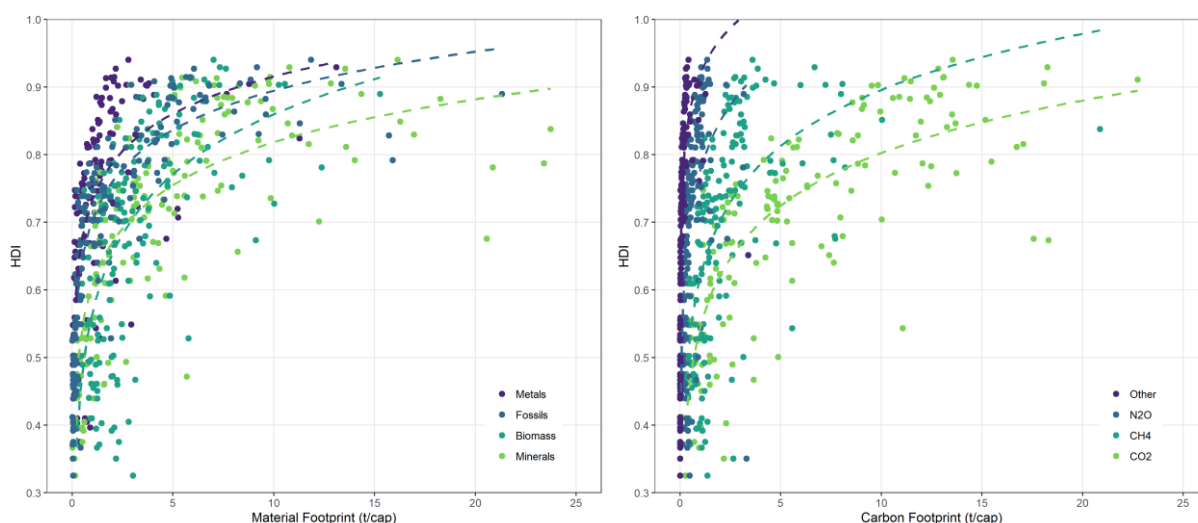


Figure S 2.1: Correlations of Material Footprint and Carbon Footprint components with HDI

Biomass and methane show a good fit for both HDI and GDP/cap (>0.6), while metals, nitrous oxide and other GHGs (like perfluorocarbons, SF_6) have a high correlation with the HDI (logarithmic model), but a lower one regarding GDP/cap (0.4-0.5); a closer examination of these components shows that there are quite a few outliers (see Supplementary Information 2,

Sheet 6). Outliers regarding CH₄ and N₂O may result from their specific nature, as emitted mostly by ruminants, unflared gas from crude oil production, and agriculture; the biomass footprint is closely connected to these GHGs, and does, as well as metal ores, vary a lot with the resource dependency of the respective country (compare Section 3.4. in main text). LFs cannot be as well explained by the HDI as MFs and CFs, and seem to require further explanators, such as population density and land use intensity. However, it is interesting that at least the demand for cropland can to some extent be explained by the logarithmic regression line. We suppose this is particularly true for intensive crops. Regarding WFs, green water and blue water seem to require further explanators like climate zone-induced endowment or scarcity, as their scatters do not fit the regression curves; grey water, in contrast, shows roughly the same behaviour as MF and CF components.

References

1. Cibulka, S.; Giljum, S. Data set: Resource footprints, quality of life and economic development. Zenodo. Version 1 **2020**, doi:10.5281/ZENODO.3713211.