

Raw material requirements for reducing global poverty calculated for the first time

Researchers at the University of Freiburg quantify the amount of material needed to enable people to live without poverty. 1.2 billion people live in poverty. To lift them out of it, an average of about six tons of raw materials are needed per person and year – in particular minerals, fossil fuels, biomass and metal ores. This is the result of a study by researchers from the Chair of Sustainable Energy and Material Flow Management at the University of Freiburg.

For the first time, the scientists quantified the necessary material input of reducing global poverty and were able to show that the areas of nutrition and mobility have a particularly large impact on resource requirements. Dr. Johan Andrés Vélez-Henao, lead author of the study, comments: "The material requirement of six tons per year to afford a person a decent life is small when compared with the resource consumption in wealthy countries. In Germany, for example, it averages 72 and in the USA 85 tons per person per year. So a little redistribution could go a long way."

Decent Living Standards – Minimum requirements of a life without poverty

In order to be able to calculate the resource requirements, the researchers first had to model the material prerequisites of a life without poverty. To do this, they used an expanded definition of the Decent Living Standards, which defines the minimum requirements for a life above the poverty line. According to this definition, a person living just above the poverty line eats about 2100 kcal per day; has a living space of 15 m² within a four-person household; has mobility of 8000 km per year; and has access to education and health facilities as well as public services, such as sports halls or administrative buildings. In addition, each person has his or her own cell phone and shares a laptop and router with the other three household members.

Six tons per person per year

Based on these assumptions, the researchers calculated the amount of resources needed to maintain the minimum requirements for a life free of poverty. On average, this material footprint amounts to about six tons per person and year. By far the largest share is accounted for by food (about 38% or 2.3 tons per person per year) and mobility (26% or 1.6 tons per person per year). The researchers attribute the influence of nutrition to the large amount of biomass and fertilizers required for food production. In contrast, housing, hygiene, education, communication, public services and clothing account for a much smaller share of the footprint. Breaking down the footprint of a poverty-free life by resource type, it is composed of 34% non-metallic minerals (such as sand, gravel, limestone and clay), 28% fossil fuels, 20% biomass (such as wood) and 18% metal ores.

Lifestyle significantly influences resource requirements

For their study, the researchers also evaluated more than 6000 different scenarios of how different supply situations and lifestyles affect the raw material requirements of poverty reduction. They showed that the material footprint of the Decent Living Standards can be halved from six to three tons per year if a person lives in multi-family home built mostly of wood, eats a vegan diet and relies on potatoes as a staple food, reduces their private automobile use and walks short distances. On the other hand, the footprint can more than double to as much as 14 tons per year if the person lives in a high-rise concrete building, subsists on a diet of meat and rice, and uses an electric car to get around.

Political implications

The study can also be used to draw political consequences for global poverty reduction and the fight against climate change and species extinction, notes Prof. Dr. Stefan Pauliuk, initiator and co-author of the study. "We urgently need to reduce our global consumption of raw materials because it is one of the main drivers of CO₂ emissions and water scarcity as well as being

responsible for around 90% of the world's biodiversity loss. But our study shows that this need not be at the expense of the poor if we better distribute resources."

However, concrete political targets for raw material consumption cannot be derived from the study, Pauliuk cautions. "For that, we need to better understand the regional characteristics of raw material use as well as the future recycling potentials of individual raw materials. But for the first time, our study gives a rough idea of the magnitude of resource demand and shows that poverty reduction and environmentally sound, sustainable resource management can go hand in hand."

Publication:

- Original publication: Johan Andrés Vélez-Henao, Stefan Pauliuk. Material Requirements of Decent Living Standards. In: Environmental Science and Technology (2023). DOI: 10.1021/acs.est.3c03957
- Blog post: Johan Andrés Vélez-Henao. How much materials are needed to provide a decent living for all? In: Industrial Ecology Freiburg Blog. <https://www.blog.industrialecology.uni-freiburg.de/index.php/2023/09/18/how-much-materials-are-needed-to-provide-a-decent-living-for-all-2/>
- Erik Stokstad: How much stuff does it take to not be poor? About 6 tons per year. In: Science Magazine, 20.9.2023, DOI: 10.1126/science.adk9666

Press release

27-Sept-2023

Source: Albert-Ludwigs-Universität Freiburg

Further information

Office of University and Science Communications

University of Freiburg

Phone: +49 (0) 0761 203 4302

Email: [kommunikation\(at\)zv.uni-freiburg.de](mailto:kommunikation(at)zv.uni-freiburg.de)

► [University of Freiburg](#)