Environmental Footprint and global mining: Spatially explicit analyses of worldwide raw material flows and associated environmental impacts

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Background and motivation

- Global demand for mining products rapidly increasing; metal ore mining has doubled in the past 20 years
- Growth in mining increasingly threatens the most vulnerable ecosystems world-wide
- Knowledge about environmental impacts of mining available on a case study level, but still scarce on a world-wide scale
- Filling this gap and linking to product supply chains as drivers is crucial to realise SDG 12 and (upcoming) EU policy demands
Impacts depend on specific location

Chile: Copper mining

Brazil: Soybean production


Mining locations and production

- Proprietary source: SNL Metals and Mining Database

An open database on global coal and metal mining

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- Data from more than 2000 freely available company reports
- 1171 mines, 80 different materials, 2000-2021
- Coverage between 30-70%
Land use of global mining

Source: Maus et al., 2022 / Nature Scientific Data
Land use of global mining

2019 satellite images: ~45,000 polygons, >101,000 km²

Source: Maus et al., 2022 / Nature Scientific Data
Mining and deforestation

Direct deforestation in tropical forests due to industrial mining expansion, 2000-2019

Source: Giljum et al., 2022 / PNAS
In 2019, half of global metal ore extraction took place at 20 km or less from protected territories.
Linking impacts to trade and consumption

- Multi-regional input-output (MRIO) models
- Top-down approach on economy-wide and sector levels
- Link national economies through bilateral trade
- Monetary, physical or combined (hybrid) MRIO approaches
- Different advantages and limitations
The extraction of which commodities was responsible for land use change and forest loss caused by mining?

The global supply chains of which final product groups are connected to mining-induced deforestation?

How is deforestation embodied in consumption distributed across countries and world regions?
Mining deforestation footprint

- Mining land use
- Forest loss
- GLORIA MRIO

Mining deforestation footprint of Top-10 consuming countries (62% of global total), by commodity, accumulated 2000-2019

Source: Giljum et al., in preparation
Mining deforestation footprint

Top-5 final consumption sectors, accumulated 2000-2019, in km²

China

- 32% Indonesia (hard coal)
- 13% Australia (bauxite)
- 8% Brazil (iron ore, copper)

USA

- 77% USA (hard coal)

Source: Giljum et al., in preparation
Conclusions and outlook

- Spatially explicit data open up a new dimension to calculate fine-scale environmental footprints
- Provide targeted knowledge to design responses by policy makers and companies
- Main data limitation: sub-national trade data to construct sub-national models in large extraction countries

Further research directions:

- Monitoring mining and metal supply chains (online tool for companies and policy makers; upcoming EU proposal)
- Mining impacts and supply chains of green energy transition
www.fineprint.global

github.com/fineprint-global

researchgate.net/project/FINEPRINT

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