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Creating global mining maps as a basis for fine-scale impact assessments

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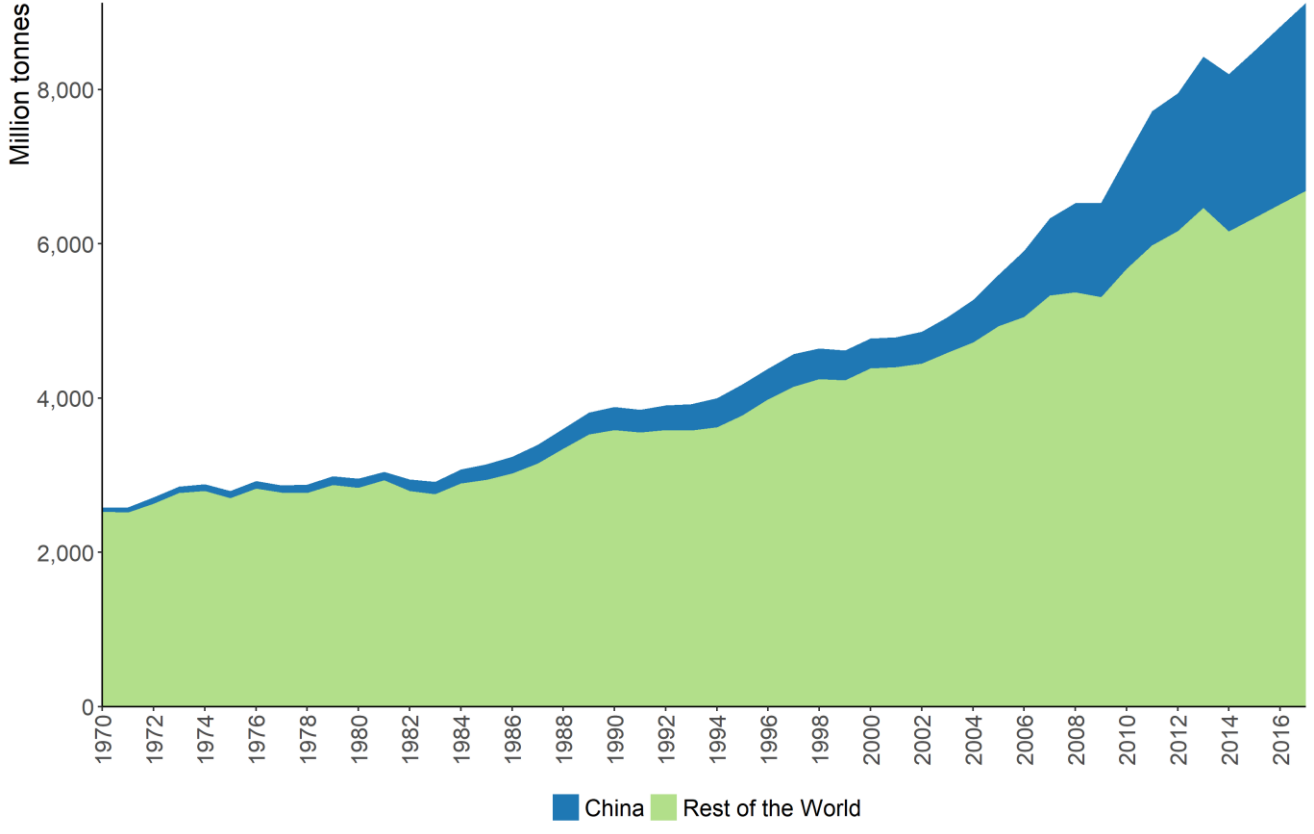
Global metal ore extraction (1970-2017)

1970: 2.6 billion tonnes

2017: 9.1 billion tonnes



Source: UN IRP (2017)

Need for spatially explicit perspective

- Geographies of global mining cannot be reduced to a national perspective
  - Expansion into formerly hardly accessible and “unproductive” areas
  - Regionally specific environmental and social impacts

http://intradayfun.com/2011/01/10-world-biggest-holes-created-by-human-and-nature/

http://www.dw.com/image/0%2C%2C19318441_302%2C00.jpg

→ Need for a spatially disaggregated perspective on resource extraction and related impacts

State of the art & advancements

- Selected metals (e.g. Duran et al., 2013; Murguia et al., 2016)
- Selected countries (e.g. Brazil: Sonter et al., 2016; Tofoli et al., 2107; Peru: Asner and Tupayachi, 2017)
- Selected impacts (e.g. water: Northey at al., 2017)

- But missing global picture across the whole mining sector

- Objectives
  - Consistent method for analyzing sub-national mining patterns
  - Spatial extraction patterns across different commodities and geographic entities
  - Links between extraction and mining-related impacts

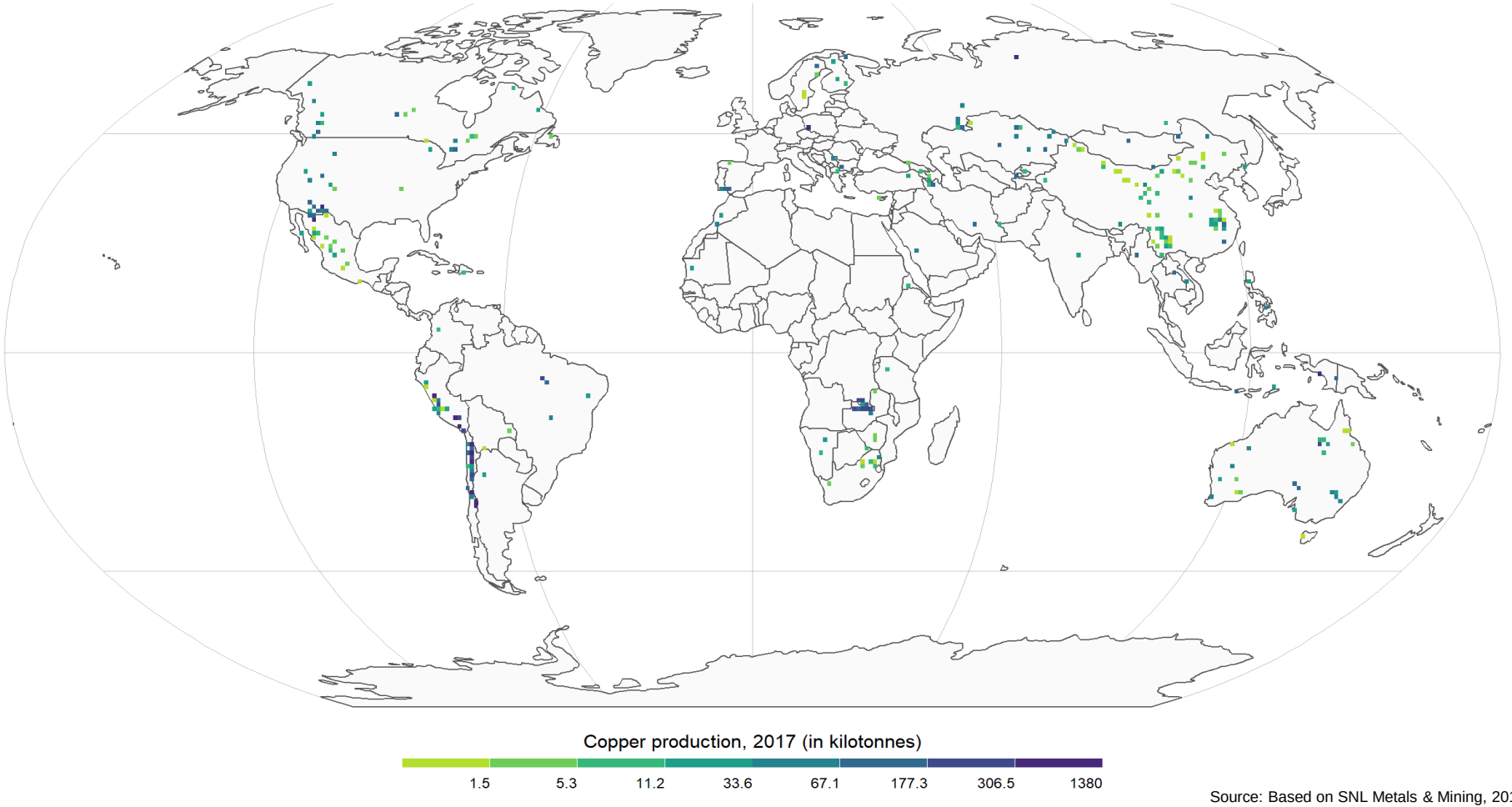
Methods & data

- Multi-method approach
  - Sub-national material flow analysis
  - Geospatial assessments and multilayer analyses
  - Visual interpretation of satellite images

- Data:
  - SNL Metals & Mining database: profiles on over 36,000 mining properties
  - 30 raw materials, 2000-2017
  - But: strong copyright restrictions oppose open science approach

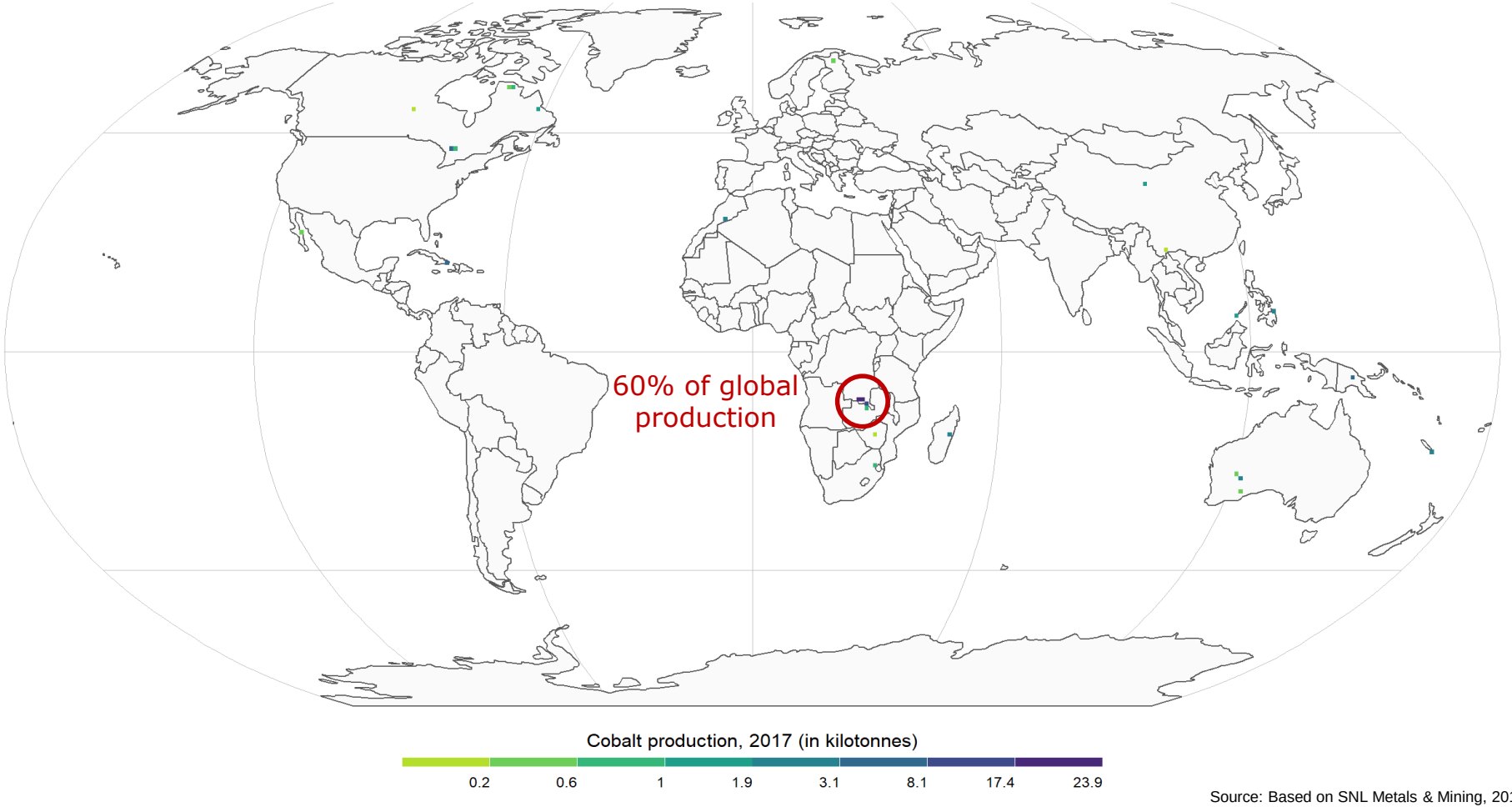
  → Upcoming: use of mine-specific national statistics and company reports

Global copper production 2017 (100 x 100 km grid)



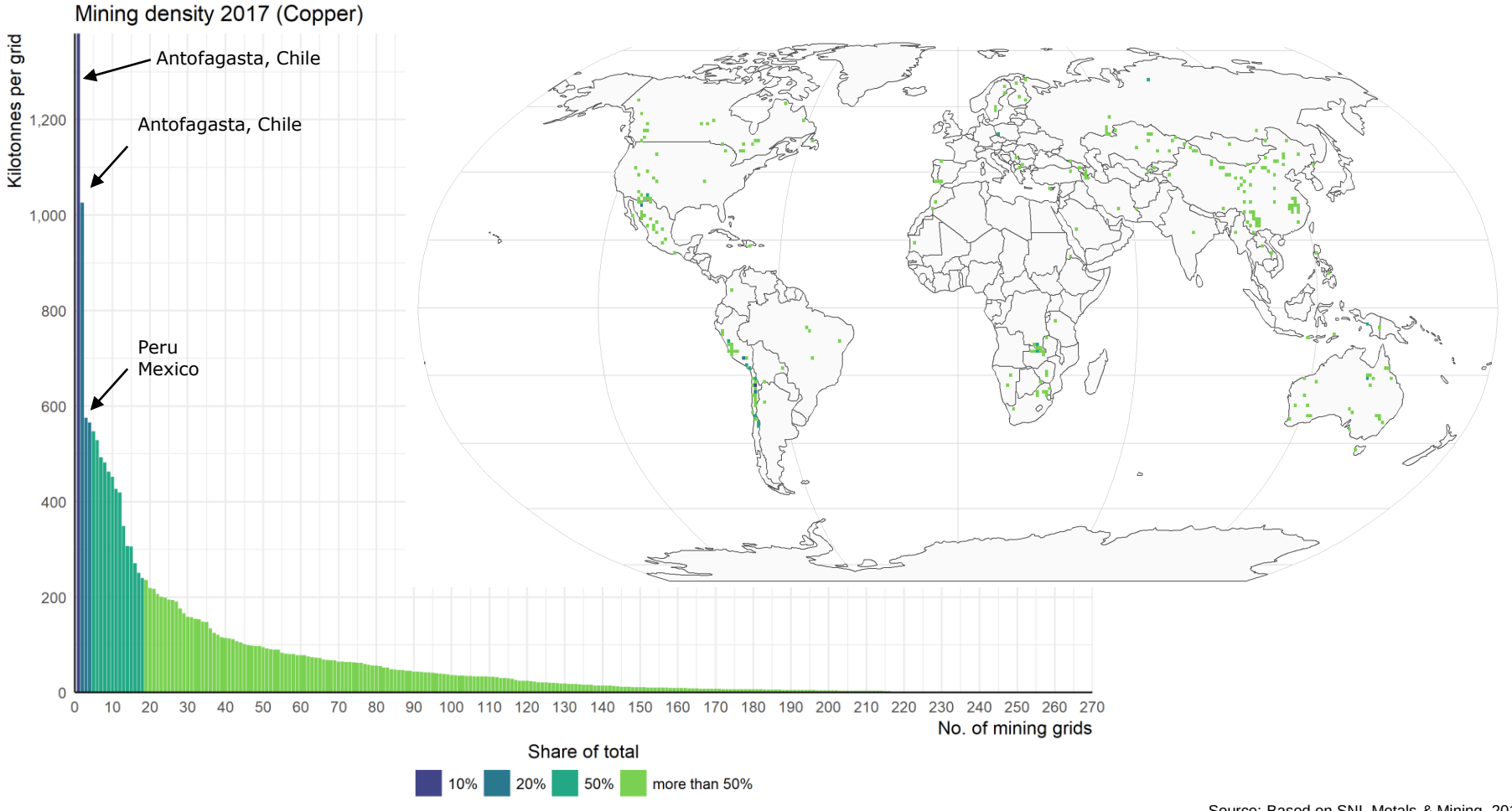
Source: Based on SNL Metals & Mining, 2018

Global cobalt production 2017 (100 x 100 km grid)



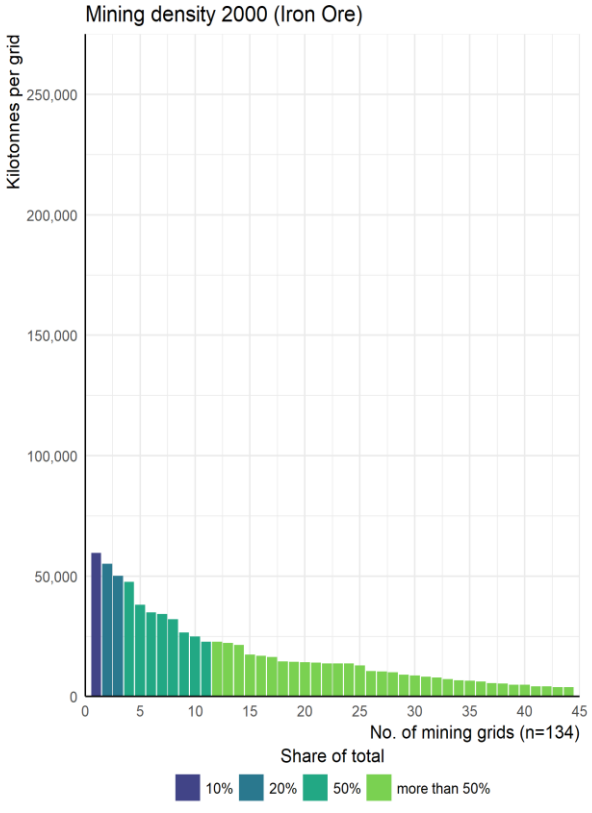
Source: Based on SNL Metals & Mining, 2018

Copper mining density per grid (100 x 100 km)

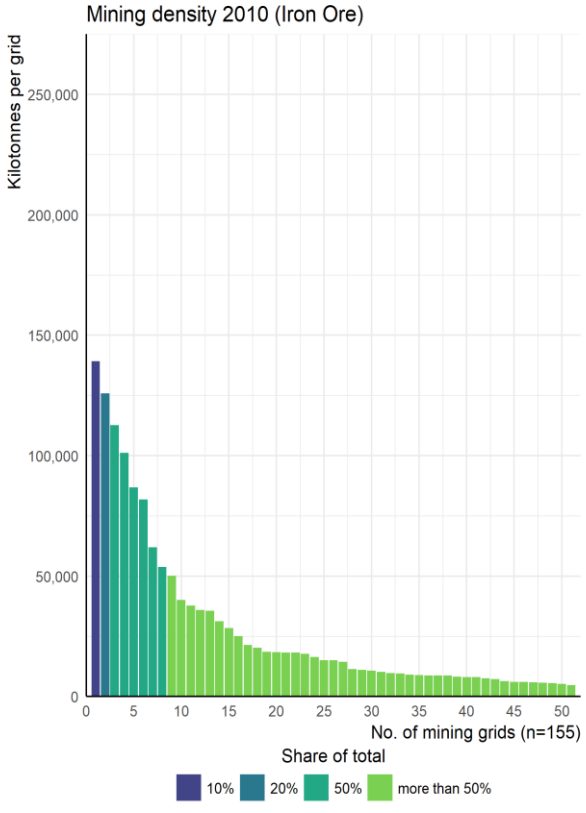


Source: Based on SNL Metals & Mining, 2018

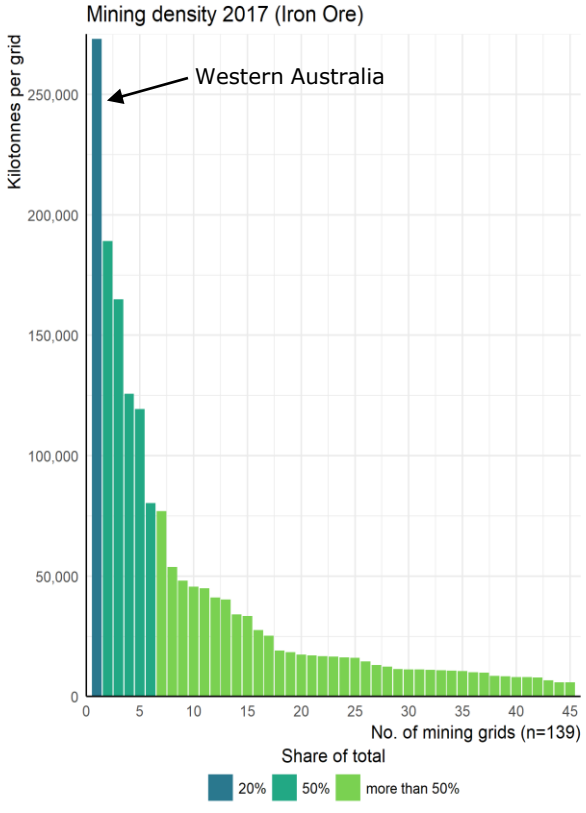
Global iron ore production per grid (100 x 100 km)



2000 total: 0.88 bnt



2010 total: 1.58 bnt



2017 total: 1.93 bnt

Source: Based on SNL Metals & Mining, 2018

From pressures to impacts

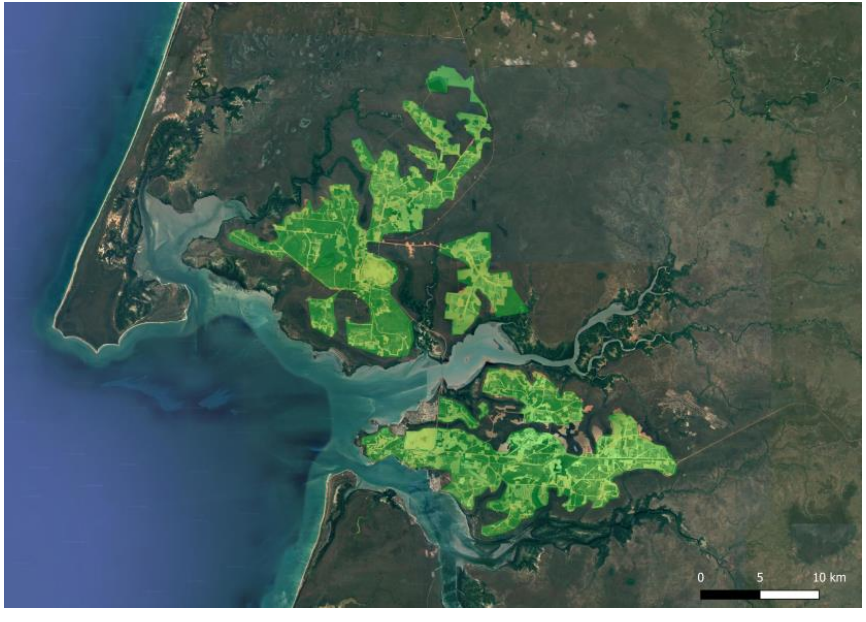
- Environmental impacts related to mining activities
  - Land appropriation
  - Water scarcity
  - Deforestation
  - Biodiversity loss
  - Pollution

Land appropriation of mining

Source: WU, 2019

Land appropriation of mining

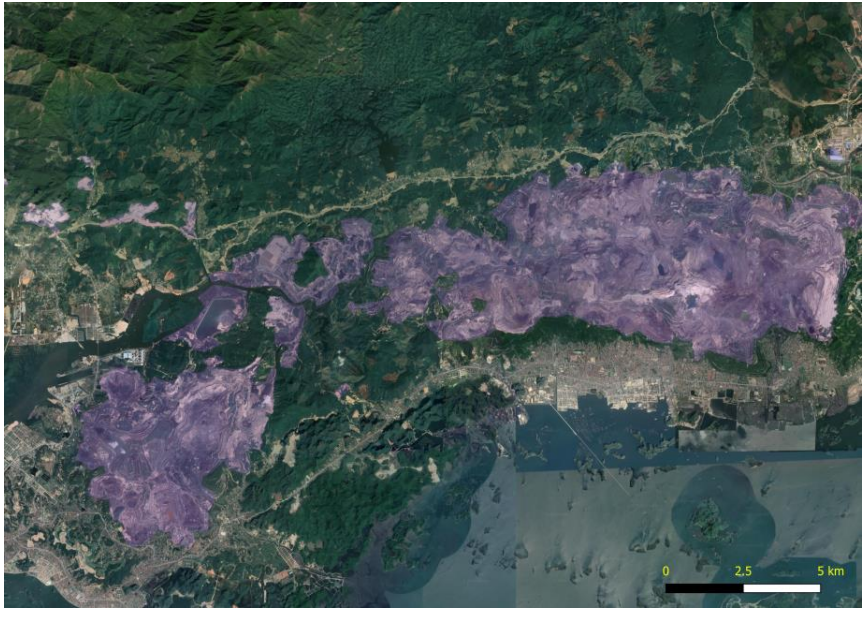
Example of Bauxite mine in Australia



Source: WU, 2019

Land appropriation of mining

Example of coal mine in Vietnam



Source: WU, 2019

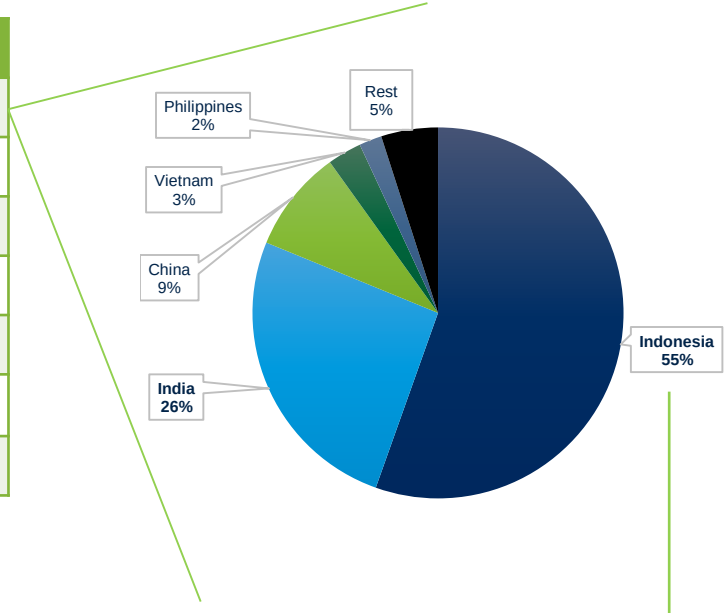
Land appropriation of mining

Vectorisation of more than 1,500 mines (4,800 polygons) in the tropical biomes

Source: WU, 2019

Direct land use of tropical mining

Distribution by Continents	Area (in km²)	in %
Asia	5,526.30	37%
South America	3,601.07	24%
Africa	3,105.44	21%
Australia and Oceania	2,310.43	15%
North America	457.52	3%
Europe (French Guiana)	8.01	0%
Total	**15,008.77**	100%



Distribution of Coal	Area (in km²)	in %
Indonesia	2,435.90	43.2%
Australia	1,470.29	26.1%
India	826.98	14.7%

Source: WU, 2019

Conclusions

- High and increasing **spatial concentration** of mining → importance of sub-national perspective
- Strong implications for related **environmental (and social) impacts**
- Use of **new sources of information**, in particular from Earth Observation, offers a range of new perspectives
- Important for developing and monitoring **strategies** to reduce negative impacts of mining

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