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Using geospatial data for assessing metal mining risks and impacts

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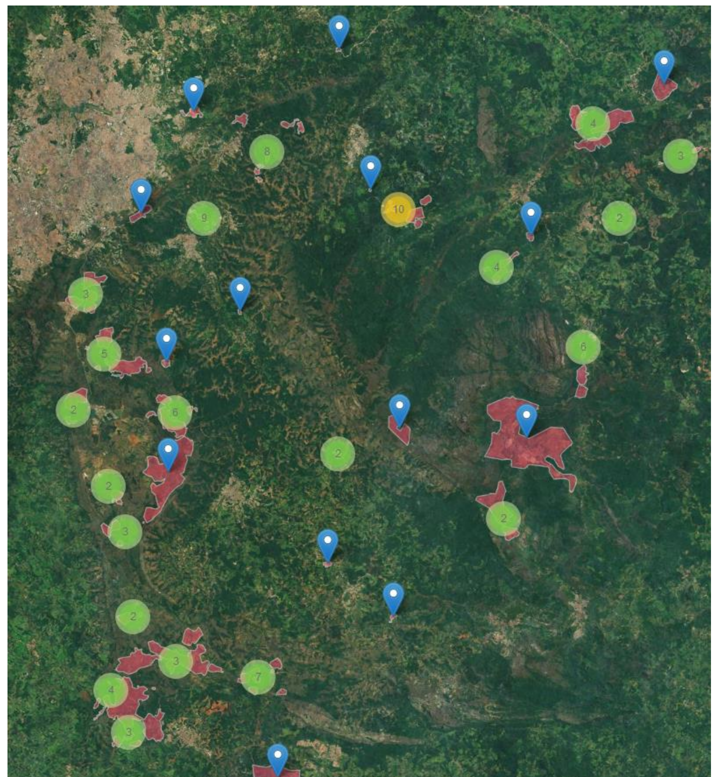
Metal mining risks and impacts

Contextual risk

- **Potential** high-impact areas
- Regional coincidence of mining and protected areas (Murguía et al. 2016), high biodiversity zones (Sonter et al. 2018), etc.

Geospatial data



Iron Quadrangle (Minas Gerais, Brazil); Source: FINEPRINT Viewer (www.fineprint.global/visualisations/viewer/)

Mining impact

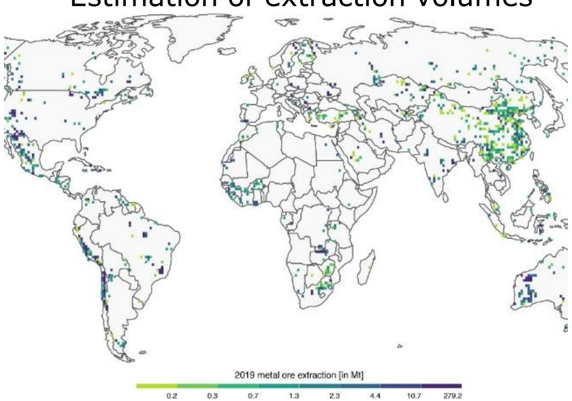
- Actual **causal** links
- We use quantitative empirical approaches
- E.g. causal links between mining and deforestation (Sonter et al. 2017, Giljum et al. *in preparation*)

Monitoring and contextual risk assessment

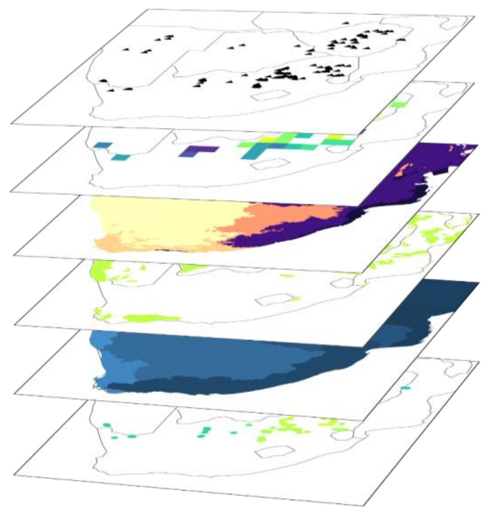
Georeferenced mining data

- **Point data** such as SNL Metals and Mining database
- **Polygon data** such as concession areas or actual land occupied by mining (Maus et al. 2020)

Luckeneder et al 2021:
- 3,000 individual mines, 9 metals
- Yearly data for 2000-2019
- Estimation of extraction volumes

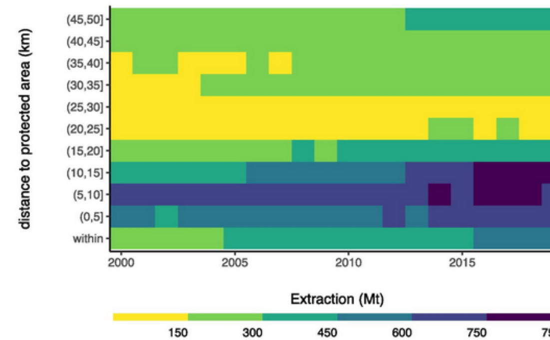


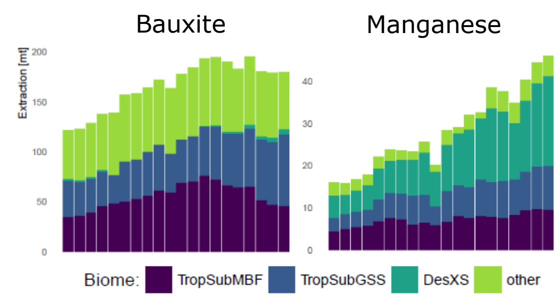
Intersection with other environmental and socio-economic geospatial data sets



- Vulnerability indicators, e.g.
  - Biodiversity
  - Protected areas
  - Water scarcity

Insights





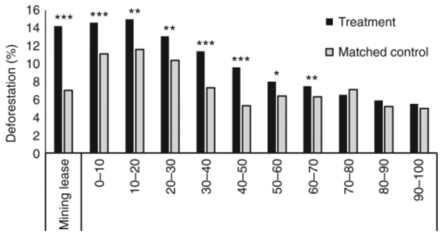
- Early warning mechanism through a trend analysis of the global mining sector
- No detection of causality

Figures taken from Luckeneder et al. 2021

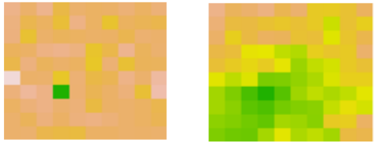
Statistical models for estimating the impacts of mining activities

Cumulative impacts

- **Spatial and temporal spillovers** need to be considered (e.g. Bebbington et al. 2020)
- Indirect effects drive deforestation in the Brazilian Amazon up to 70 km beyond mining leases (Sonter et al. 2017)



- Enclave economies vs. beneficial economic agglomeration effects (Arias et al. 2013)



Spatial econometric methods

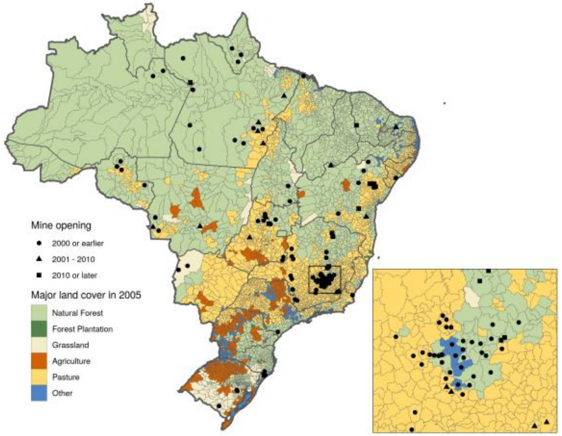
- Consideration of spatial dependence using weights (LeSage and Pace 2009)

- Enables **computation of direct and indirect impacts**

Application

Regional economic and land cover effects of mining activities in Brazil

- 5,249 Brazilian municipalities
- Panel for 2005-2013, land cover and socio-economic data



	Pre 2010		Since 2010	
	Direct	Indirect	Direct	Indirect
GDP growth	+	+	0	-
Forest cover	-	-	-	0

Main takeaways

- Using spatial data has high potential for **better mining management and policies**
  - Better monitoring, taking spatial heterogeneities into consideration
  - Spatial dependence → cumulative impacts
- Current **challenges and limitations**
  - Data
    - Rarely geocoded
    - Limited public information at the mine-level, e.g. extraction volumes
    - Insufficient temporal information, e.g. mine openings
  - Methods
    - Modelling heterogeneous connectivities between spatial units
  - Other
    - Interdisciplinary collaboration, involvement of "mining experts"

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Thank you!

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