Biodiversity impacts of recent land-use change driven by increases in agri-food imports

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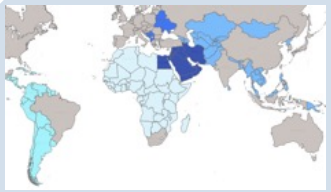
Motivation

- **Tropics** are the hotspot of biodiversity loss from land-use change (LUC)
- Land is used for producing commodities **exported** and consumed abroad

Assessing spatially-resolved global biodiversity impacts resulting from LUC between 1995 and 2022

Identifying how shifts in supply chains contribute to LUC impacts over time using multi-regional input-output (MRIO) analysis

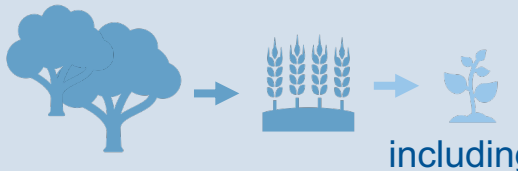
Methods

1. 

189 countries x 163 sectors, 1995–2022

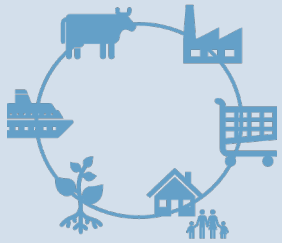
Compile MRIO database Resolved EXIOBASE (REX3)

Stadler et al 2020 (EXIOBASE 3), Lenzen et al 2016 (Eora26), FAOSTAT, BACI (trade)

2. 

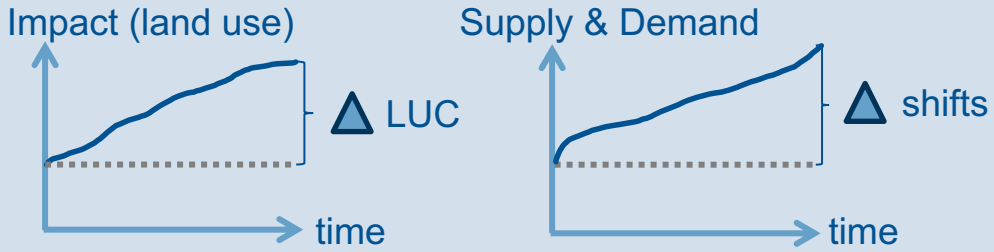
Calculate land-use change impacts from 1995 to 2022

LUH2 dataset, Chaudhary et al 2015, UNEP-SETAC 2016

3. 

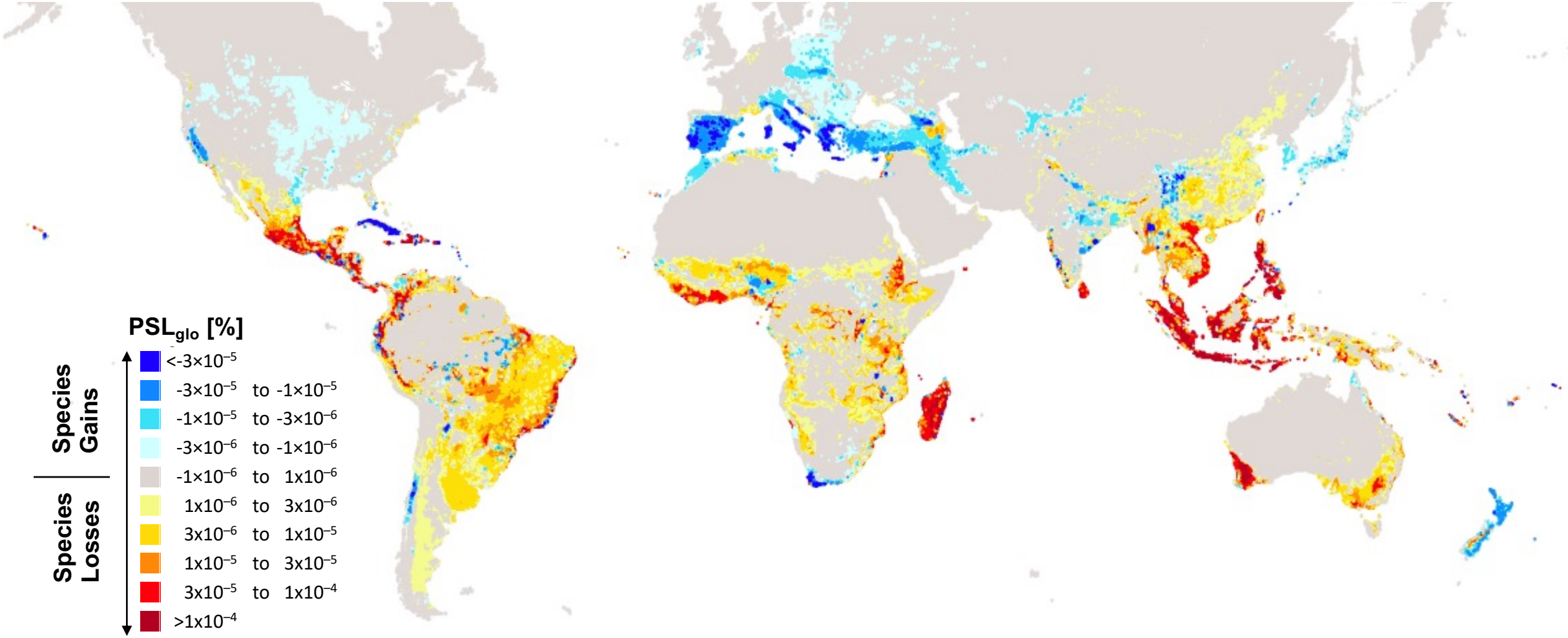
Assess full supply chain impacts without double counting

Cabernard et al. 2019

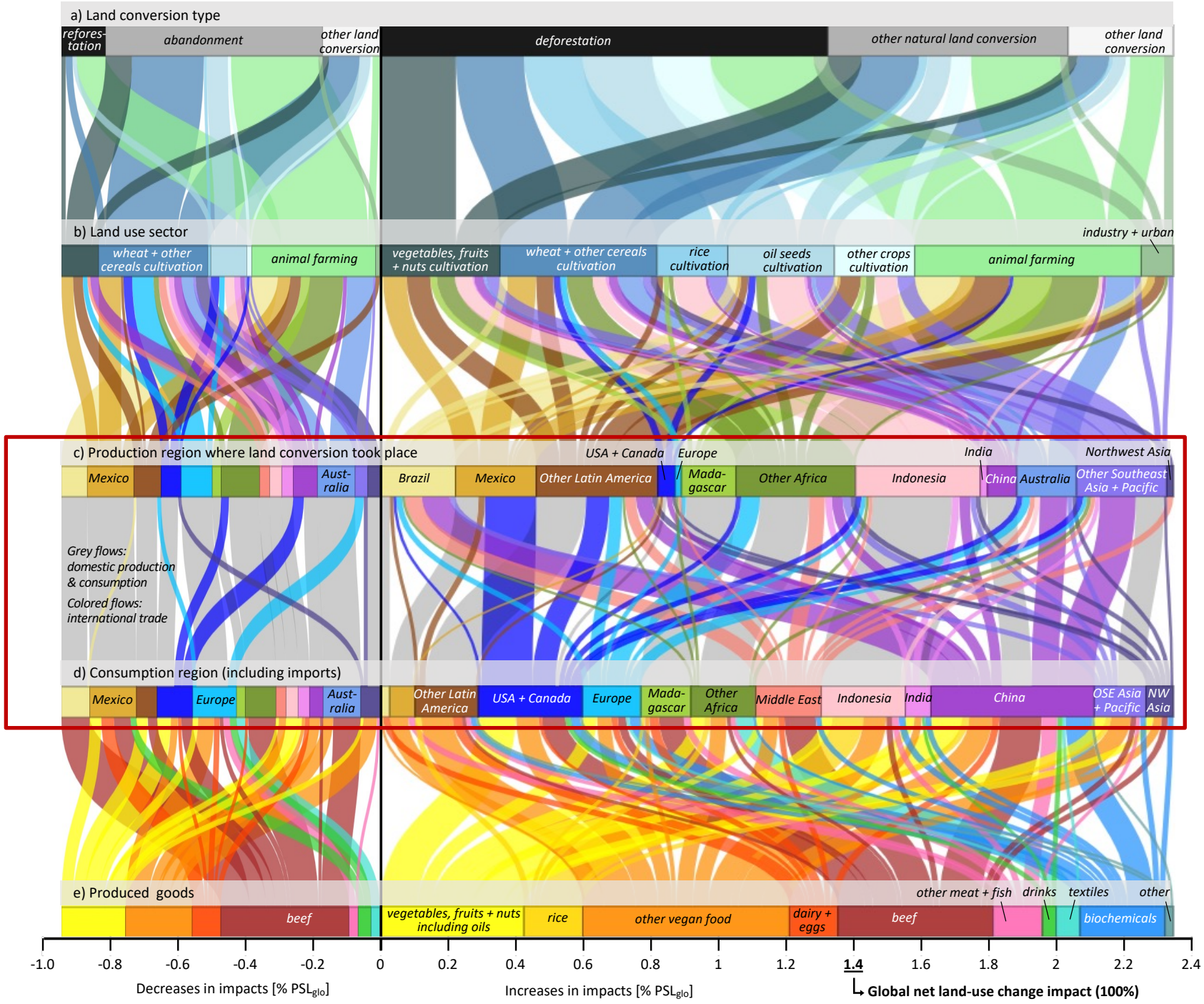
4. 

Marginal allocation: Allocate LUC impacts to shifts in supply and demand

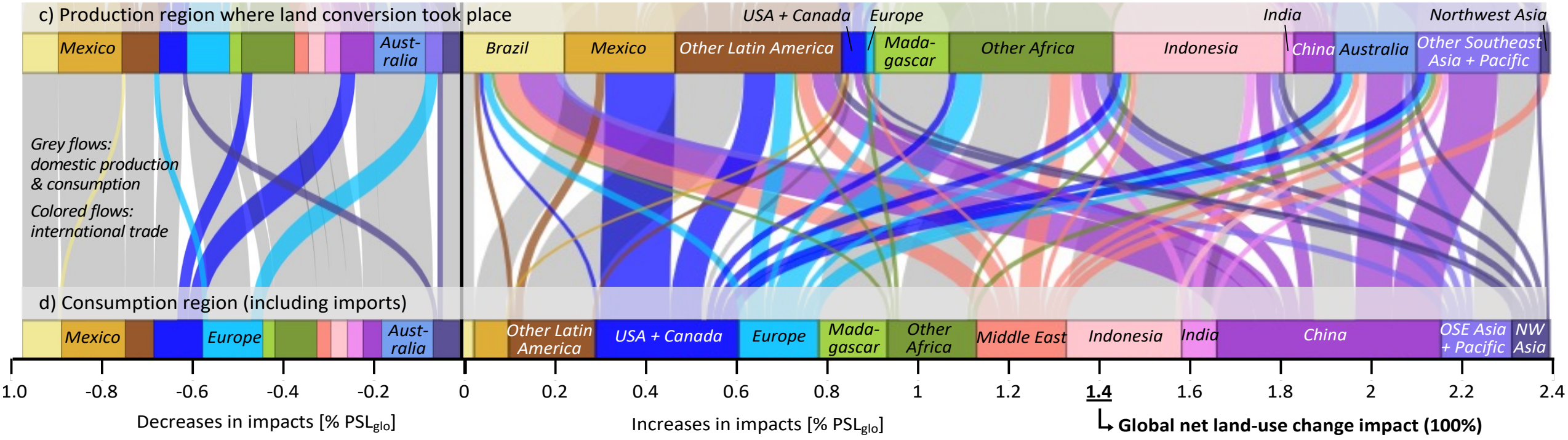
Results: Land-use change biodiversity impacts from 1995 to 2022



Results: Global land-use change impacts linked to shifts in the supply chain from 1995 to 2022



Results: Global LUC impacts linked to shifts in the supply chain from 1995 to 2022:



Discussion and Conclusions

Methodical improvements

- Marginal vs total allocation in MRIO leads to three times higher impacts embodied in trade
- Spatially-resolved global LUC impact assessment including land abandonment →40% higher LUC impacts
- REX3 database (https://zenodo.org/records/10354283) covers 189 countries, 163 sectors & set impact categories: biodiversity loss from land use and land-use change, water stress, climate and PM health impacts

Limitations & Outlook

- Account for land-use intensities and fragmentation →Scherer et al 2022
- Link REX3 to FABIO & FORBIO for enhanced product resolution →Bruckner et al
- Scenario implementation

Policy implications

- Biodiversity gains in temperate regions came at the expense of outsourcing agri-food supply chains to tropical biodiversity hotspots →Net LUC impacts exceed the biodiversity target ~50-fold
- We need policies to i) protect high-biodiversity regions by halting habitat destruction and ii) stop countries from importing agri-food products from tropical biodiversity hotspots.

References

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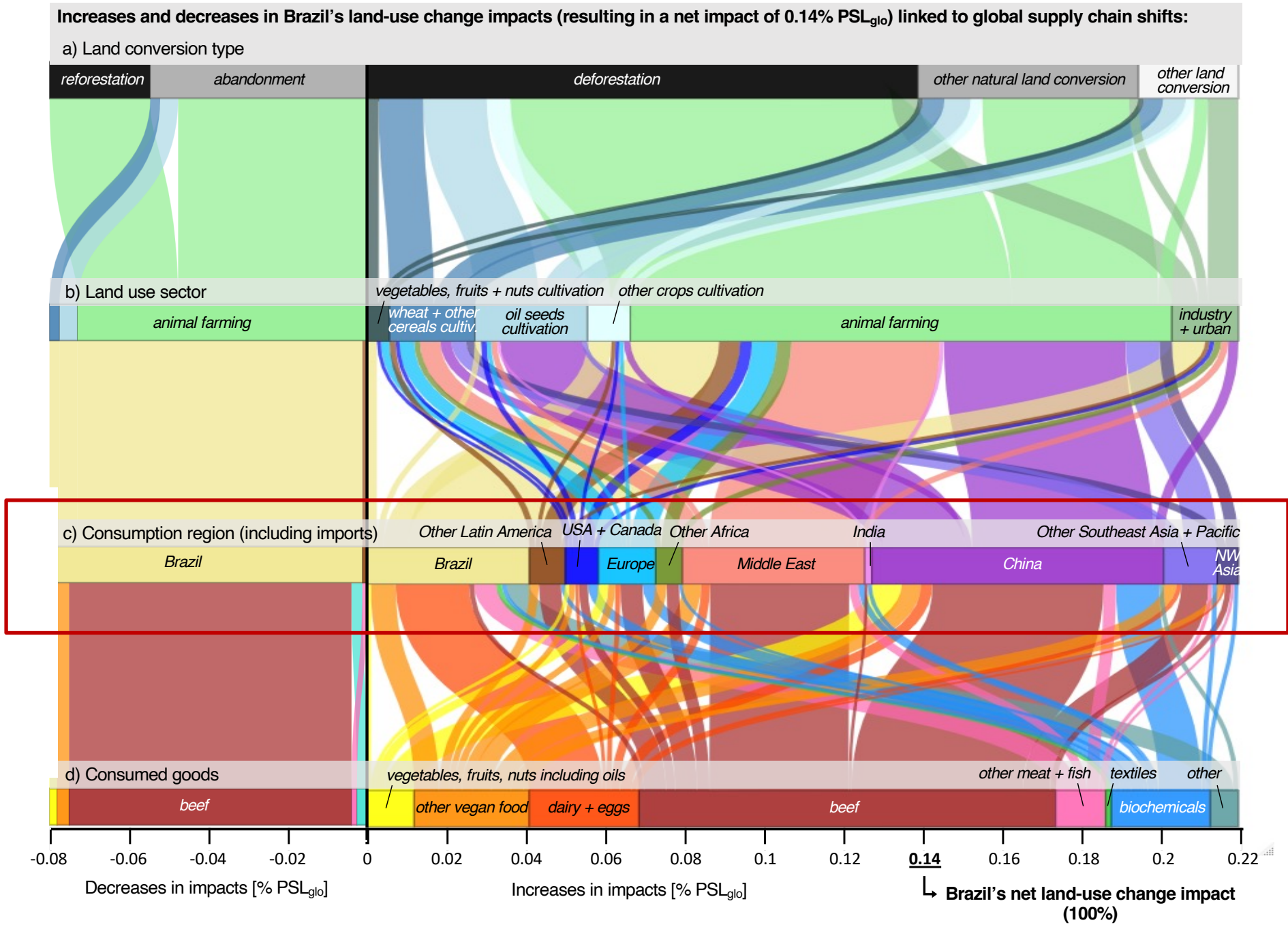
Additional slides

Results: Brazil's land use change impacts linked to shifts in the supply chain from 1995 to 2022

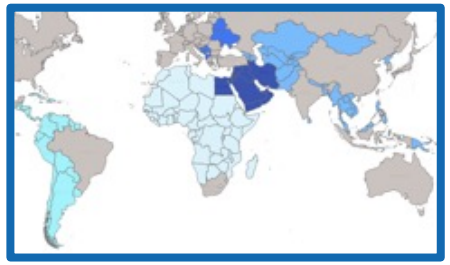
→without exports impacts would have decreased



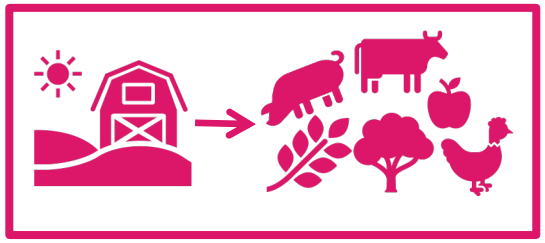
An MRIO database with high regional and sectoral resolution

EXIOBASE3
49 regions & 163 sectors

5 rest of the world regions

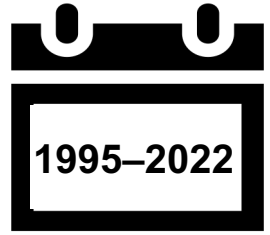


Eora26
189 countries & 26 sectors

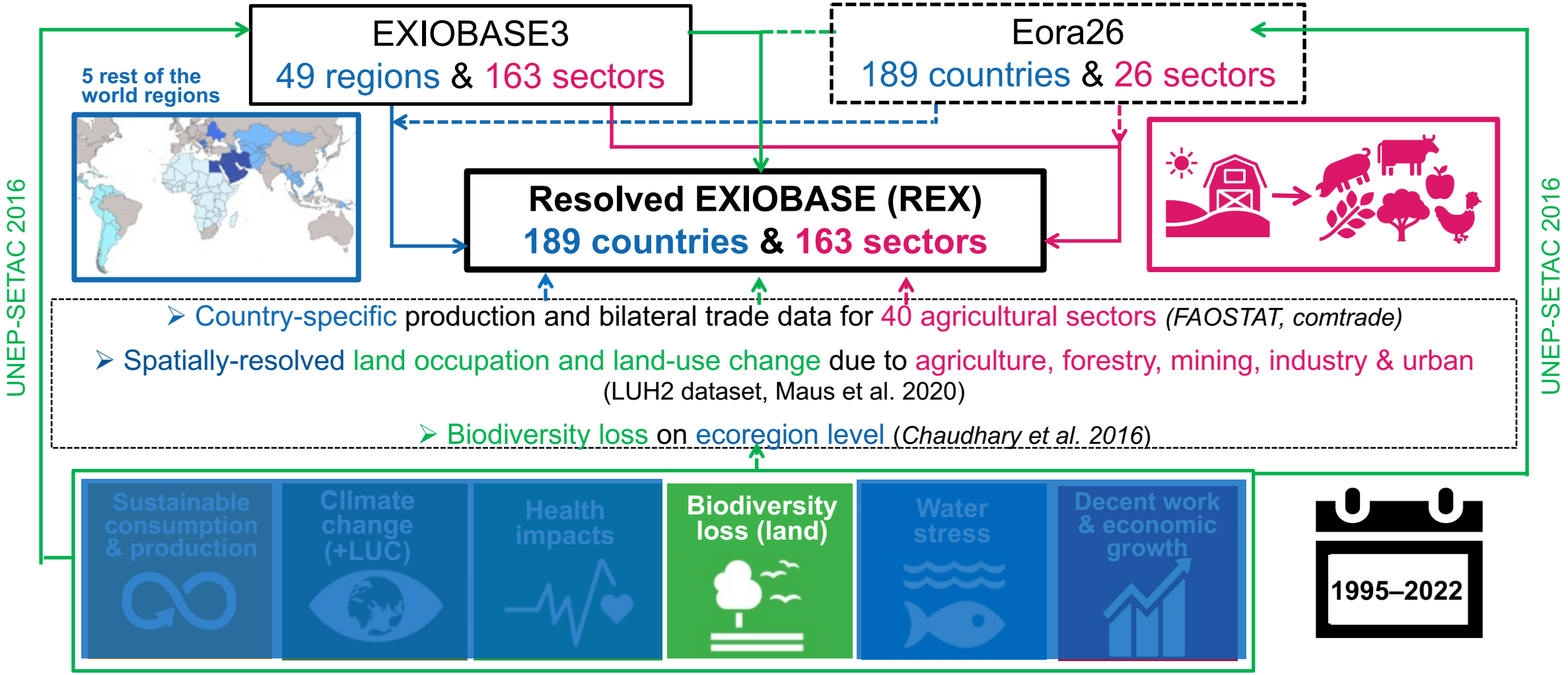


Resolved EXIOBASE (REX)
189 countries & 163 sectors

➢ Country-specific production and bilateral trade data for 40 agricultural sectors *(FAOSTAT, comtrade)*

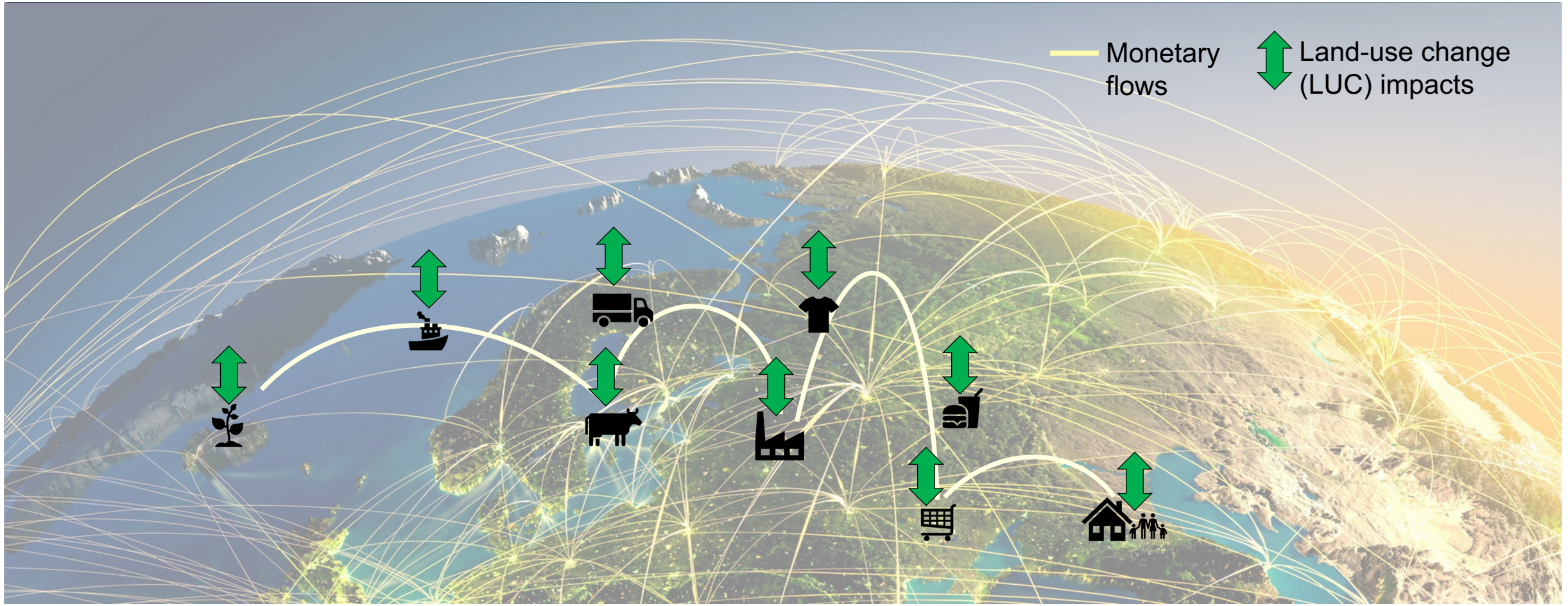


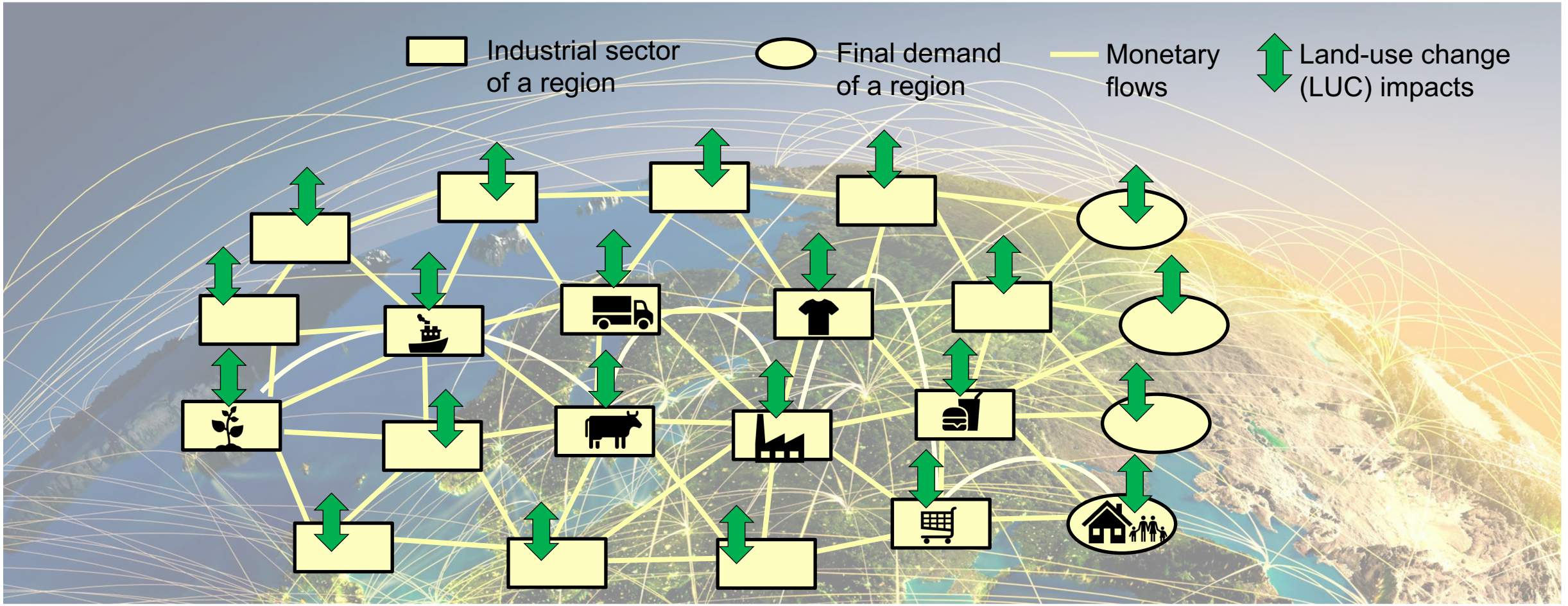
An MRIO database with high regional and sectoral resolution and comprehensive regionalized impact assessment



Methods

Environmentally-extended Multi-regional Input-Output (MRIO) Analysis



Methods

Environmentally-extended Multi-regional Input-Output (MRIO) Analysis