

Extending EXIOBASE with UNEP-GLAM: An EE-MRIO Framework for Assessing Ecosystem Quality, Human Health, and Socio-Economic Assets

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Understanding the environmental and social consequences of global production, trade, and consumption requires metrics that can be applied consistently across sectors and international supply chains. EE-MRIO models are well suited to this task since they link economic activity to environmental pressures embodied in production and trade. Their use in impact assessment, however, depends on the availability of characterization factors that can be coherently connected to the environmental extensions represented in the IO framework.

This paper presents the development of a spend-based impact factor dataset by linking the global EE-MRIO database EXIOBASE to UNEP's Global Guidance for Life Cycle Impact Assessment Indicators and Methods (UNEP-GLAM). This work has been carried out in the context of the EU Horizon projects BAMBOO and RAINFOREST. EXIOBASE is among the most detailed global EE-MRIO systems and is widely used in footprint analysis, consumption-based accounting, and the derivation of spend-based Scope 1, 2, and 3 emission factors. In addition to greenhouse gas emissions, it includes a broad set of environmental extensions, such as land use, water use, nutrient emissions, and material extraction. By translating these stressor accounts into ILCD-conform flow names, EXIOBASE can be linked to the UNEP-GLAM characterization framework.

The resulting linkage enables the derivation of supply-chain multipliers for the three UNEP-GLAM Areas of Protection: ecosystem quality, human health, and socio-economic assets. We discuss the main methodological issues arising in this process, including classification correspondences, differences in sectoral and spatial detail, and the assumptions required to translate stressor data into endpoint indicators. We argue that these challenges are central to the further development of impact-oriented EE-MRIO analysis.

The new dataset extends the analytical scope of EXIOBASE by providing spend-based impact factors as well as consumption based accounts for all sectors and all three Areas of Protection. Together with the existing EXIOBASE-based indicators for major environmental pressures, this supports more comprehensive assessments for research, public policy, and corporate sustainability reporting. Selected empirical results illustrate the distribution of impacts across regions, sectors, and final demand categories, while also showing how the ILCD-conform satellite account can support future harmonization with other assessment frameworks such as LC-IMPACT and the EU Product Environmental Footprint.