

Unravelling biodiversity impacts of consumption: a production layer decomposition analysis for the Netherlands

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Unsustainable consumption patterns, through factors like land use, greenhouse gas (GHG) emissions, and pollution, are significant drivers of global biodiversity loss. Particularly high-income countries such as the Netherlands exert environmental pressure on biodiversity with their consumption patterns. Targeted policy is needed to combat biodiversity loss, policy which aims at consumers of goods and services as well as actors in worldwide supply chains

In this paper, we demonstrate the usefulness of unravelling biodiversity footprints, including the direct and indirect biodiversity impacts of final consumers, in order to examine in detail the location of impacts on biodiversity in the supply chain of consumption. We do so by performing a production layer decomposition, a method related to structural path analysis. Our paper is the first to decompose production layers for biodiversity consumption footprints in order to identify relevant points of intervention for policies to mitigate biodiversity loss.

We illustrate our method for the Netherlands as an example of a high income country and for biodiversity footprints that are expressed as losses in Mean Species Abundance (MSA). We use the ICIO tables of the OECD, extended with environmental data on GHG emissions, nitrogen emissions and land use from Eurostat, FAOstat and other sources. In 2015, Dutch consumption resulted in 16 million MSA-loss $\cdot$ ha $\cdot$ yr all over the world. Of these losses, 12% originated directly from consumers, 29% from production within the Netherlands for Dutch final demand, and 59% from upstream suppliers that were based abroad. Losses due to final consumers themselves, mainly households, include land use for housing, or GHG emissions from motor fuels. Overall, housing and food contributes most to the Dutch biodiversity footprint. Our decomposition analysis shows that housing also generates the largest loss in sectors directly producing for Dutch consumption, while goods and services have more losses further upstream in their supply chains.

The relevance of our findings is that to reduce biodiversity impacts of consumption, actors in different parts of the supply chain have to be targeted depending on the consumption category. In particular, this study exemplifies the need to address the impacts of processes far upstream in global supply chains. Such a broader spatial scope demands that policies to reduce footprint impacts have to use more instruments and foreign governance strategies than just focusing on territorial impacts. This demand was stimulated by target 15 of the CBD Global Biodiversity Framework (CBD 2022) on assessing impacts and dependencies by large multinational companies and financial institutes. The policy options for reducing biodiversity losses should address various factors, including pressure, location (domestic or abroad), sector, actor and the path of the supply chain. These factors differ according to the consumption category in question, as well as businesses involved. Specific policies are needed per product group, as different pressure priorities and governance approaches are required. The information from this study is especially relevant when supply-chain responsibility issues are addressed, like what is now demanded in the EU Corporate Sustainability Reporting Directive (CSRD) and Directive on Corporate Sustainability Due Diligence (CSDDD).

A significant part of the footprint (39%) relates to GHG emissions in the Netherlands and the EU. These emissions are covered by climate and energy policies in these regions. Achieving the emission reduction targets set for the target years 2030 (55% reduction) and 2050 (no net GHG

emissions) will make an important contribution to the reduction of the Dutch biodiversity footprint. Achieving national targets for nitrogen emissions specified per sector can also contribute to a lower footprint. Ultimately, our study emphasises the necessity for distinct policy approaches for supply chain impacts, both national and international in scope, to reduce global biodiversity loss, whilst ensuring that any adverse impacts are not displaced to other nations.