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Food Loss Hidden Burdens: Assessing International Trade-Related Food Loss Environmental Implications

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Abstract

Reducing food loss is a critical imperative for global food security and sustainable resource management. Modern food systems are increasingly globalized, leading to a geographical decoupling of production and consumption. This spatial disconnection often leads to the externalization of environmental impacts, in which the burdens of food loss, primarily during the production and supply stages, remain hidden from final consumers and unaccounted for in local sustainability assessments. This study addresses this gap by examining the environmental implications of food loss embedded in international agricultural trade, focusing on the inter-regional linkages that define telecoupled food systems. Using a multi-year global dataset of trade flows at the product level, we quantify the scale of trade-related food loss and its associated environmental footprint, encompassing land and water use and GHG emissions. To operationalize these findings, the study introduces an analytical framework: the 'Telecoupled Environmental Performance Index' (TEPI). This index integrates the environmental performance ratings of production and consumption regions, reflecting the inter-regional responsibility derived from consumption-weighted sourcing portfolios. Our results reveal that demand from importing regions drives significant environmental burdens in agricultural production zones through trade-related food loss. These findings demonstrate that consumption patterns in one region directly shape the distribution of environmental pressures across the global food system, uncovering burdens that escape existing national sustainability metrics. The study highlights that food loss in international trade is not merely a local production inefficiency but a systemic phenomenon with global environmental consequences. By merging food loss analysis with the telecoupling approach, this research provides a methodological foundation for developing more equitable trade, consumption, and climate policies. The insights generated offer policymakers a practical tool for evaluating alternative trade pathways and integrating environmental accounting into food system governance, ultimately supporting the design of more resilient and sustainable global food systems.

Keywords: Food loss, Environmental impact, Interrigenal trade, Telecoupling

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